BreezeNET PRO Series

System Administrator Guide

Revision E

October, 1997
Cat. No. 213011

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Warranty

In the following warranty text, "the Company" shall mean:
- Breeze Wireless Communications Inc., for products located in the USA.
- Breeze Wireless Communication Ltd., for products located outside the USA.

This BreezeNET product is warranted against defects in material and workmanship for a period of one year from date of purchase. During this warranty period the Company will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, the product must be returned to a service facility designated by the Company. Authorization to return products must be obtained prior to shipment. The buyer shall pay all shipping charges to the Company and the Company shall pay shipping charges to return the product to the buyer within the USA.

The Company warrants that the firmware designed by it for use with the unit will execute its programming instructions when properly installed on the unit. The Company does not warrant that the operation of the unit or firmware will be uninterrupted or error-free.

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REGULATORY NOTICE

THIS EQUIPMENT HAS BEEN TESTED AND FOUND TO COMPLY WITH THE LIMITS FOR A CLASS A DIGITAL DEVICE, PURSUANT TO PART 15 OF THE FCC RULES.
THESE LIMITS ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINST HARMFUL INTERFERENCE WHEN THE EQUIPMENT IS OPERATED IN A COMMERCIAL ENVIRONMENT.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

This device may not cause harmful interference.

This device must accept any interference received, including interference that may cause undesired operation.

Notice to User

Any changes or modifications of equipment not expressly approved by the manufacturer could void the user's authority to operate the equipment.

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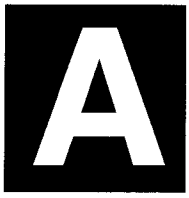


INTRODUCTION

1. INTRODUCTION TO THE *BREEZENET PRO SERIES*

1.1. The *BreezeNET PRO Series*

Since BreezeNET was originally released, the IEEE 802.11 specification for wireless LANs has evolved, and with it, so has BreezeNET. The new ***BreezeNET PRO Series*** incorporates and takes full advantage of all changes to the specification in order to deliver improved performance, flexibility, reliability and enhanced functionality.

The following is just part of what's new in the ***BreezeNET PRO Series***:

- Improved performance: ***BreezeNET PRO*** still has the fastest FHSS but now provides a 30% greater net throughput.
- Increased Range: Check out the new PCMCIA adapter (SA-PC Card) and 7.2 dBi omni-directional antenna kit.
- Enhanced SNMP: Dual "active" MIBs, view and/or change Ethernet and Wireless settings.
- All-new 2 Mbps PCMCIA Adapter: The SA-PC Card has the highest throughput available in a one-piece folding diversity antenna.
- Fully integrated product family: One high-performance Access Point for all products in the series.
- Upgrading from Version 2.71 to PRO: Fast and affordable upgrades are performed at the factory by experts.
- Future-proof Investment: All "infrastructure" items in the PRO Series line offer Flash updates.
- Guaranteed 802.11 Compatability: Upgrades will be made available for all updates of the standard.

*Note: If you're adding a **BreezeNET PRO Series** product to an existing BreezeNET installation see section 3.10., "Versions Compatibility".*

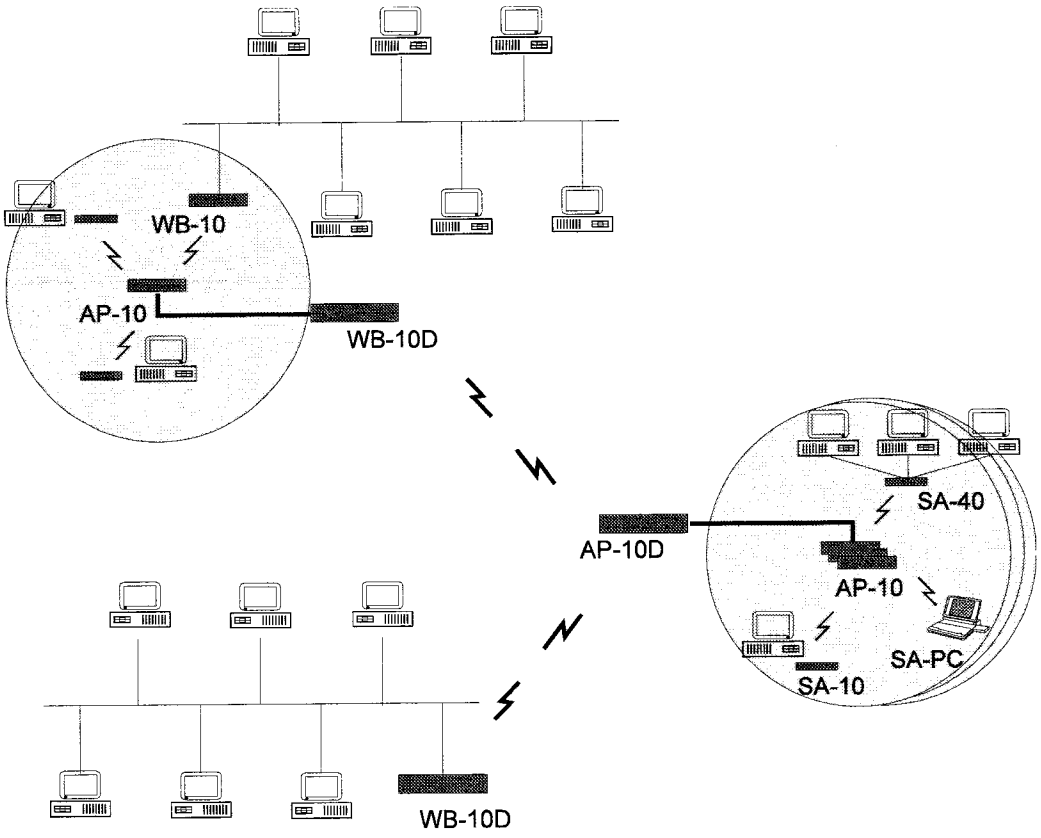


Figure 1.1: Wireless LAN

The ***BreezeNET PRO Series*** product line consists of:

- The AP-10 PRO Access Point.
- The SA-10 PRO Single Station Adapter.
- The SA-PC PRO PC Card Adapter.
- The SA-40 PRO Four Port Station Adapter.
- The WB-10 PRO Wireless Bridge.

1.1.1. The AP-10 PRO Access Point

The ***BreezeNET*** AP-10 PRO is a wireless hub that provides access for wireless workstations into wired Ethernet LANs. It also contains the coordinating function that enables workstations equipped with a Station Adapter to communicate with one another inside the cell coverage area (even if they are not in direct line of sight) via the Access Point. Any two wireless stations in two different cells can communicate through their Access Points.

Mobile workstations can "roam" between Access Points that belong to the same Extended Service Area (ESA). In an Extended Service Area, all Access Points have the same ESSID. When the access points are set up so that their coverage areas overlap, users can roam "seamlessly" from cell to cell.This means that there is no interruption of network connection when moving from one coverage area to the other through the overlap. The Station Adapters "decide" when a mobile user becomes disassociated from one access point and associated with another. This process is fully transparent, requires no user intervention and involves no loss of data packets.

Position multiple access points (up to 15) in locations where heavy network traffic is expected to create a multicell and increase the aggregate throughput capacity in areas where it is needed most.The system implements a Load Balancing algorithm to divide the stations equally between the available co-located Access Points.

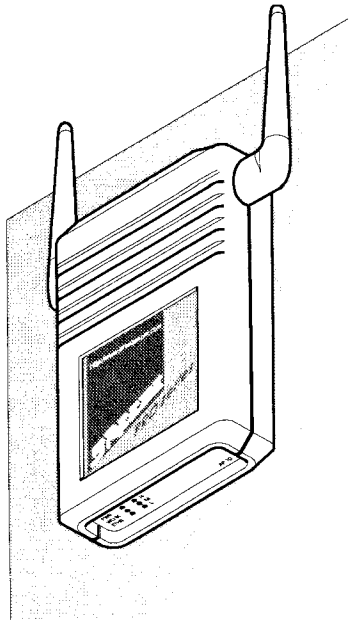
The ***BreezeNET*** AP-10 PRO contains an embedded SNMP agent enabling effective management. Software upgrades can be downloaded by TFTP protocol via the wired LAN.

The AP-10 PRO is designed to meet the specifications of the upcoming IEEE 802.11 wireless LAN standard.

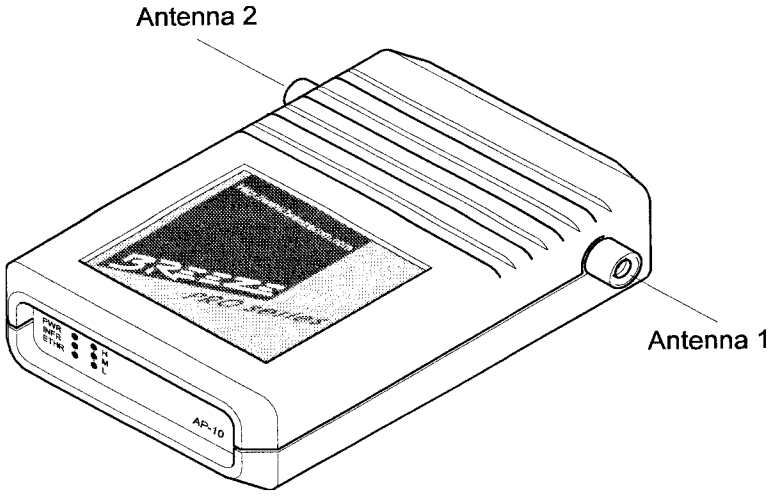
AP-10 PRO Models

The AP-10 PRO is available in two models:

- AP-10 PRO with two built-in omni-directional antennas



- AP-10D PRO for use with external high-gain antenna(s).



1.1.2. SA-10 PRO Single Station Adapter

The ***BreezeNET*** SA-10 PRO is a wireless LAN adapter that converts any computer equipped with an Ethernet interface into a wireless LAN station. The SA-10 PRO is transparent to the computer's hardware and software. This enables plug-and-play installation.

The SA-10 PRO enables its workstation to communicate with any other wireless stations in the same cell coverage area, and to access all network resources such as file servers, printers and shared databases via the ***BreezeNET*** AP-10 PRO Access Point. Any two wireless stations in two different cells can communicate through their Access Points.

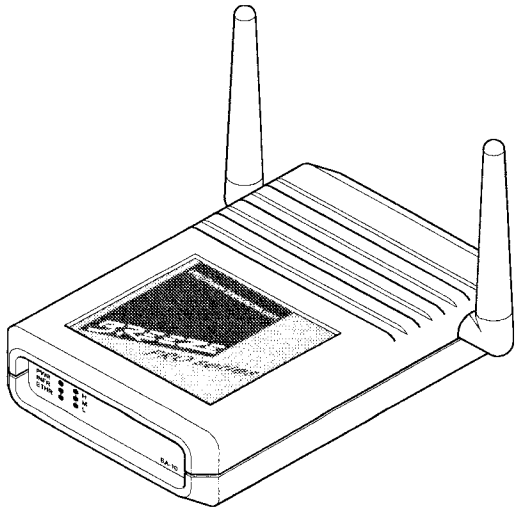
The SA-10 PRO contains an embedded SNMP agent enabling effective management. Software upgrades are downloaded by TFTP via the Ethernet port or via the Wireless LAN and Access Point.

Network connection is maintained while roaming between overlapping coverage areas. Transmission and reception can be continued while moving at high speed with no data packet loss or duplication.

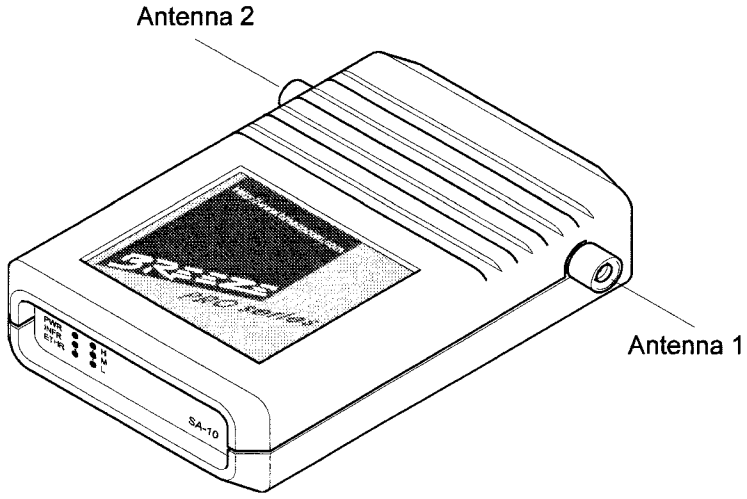
SA-10 PRO Models

The SA-10 PRO is available in two models:

- SA-10 PRO with two built-in omni-directional antennas.



- SA-10D PRO for use with external antenna(s)



1.1.3. - SA-PC PRO PC Card Adapter

The SA-PC PRO PC Card Adapter gives the portable computer user continuous connectivity and complete mobility, allowing seamless roaming throughout the wireless LAN campus.

The ***BreezeNET*** SA-PC PRO PC-Card Adapter converts any portable computer (Notebook, Lap-top, Pen-based etc.) containing a PCMCIA Release 2.1 Type II slot into a wireless LAN workstation.

The SA-PC PRO adapter can communicate with any other wireless station in its cell coverage area, and can access all network resources such as file servers, printers and shared databases via the ***BreezeNET*** AP-10 PRO Access Point.

Network connection is maintained while roaming between overlapping cell coverage areas. Transmission and reception can be continued while moving at high speed with no data packet loss or duplication.

Peer-to-Peer Networking

Besides connecting to a wireless network by associating with an Access Point, two or more computers using the ***BreezeNET PRO*** SA-PC Card can be linked in a wireless local area network. This is often called an *AD HOC*

network because it can set up temporary communication such as at a meeting of audit teams at customer sites. It is easy to disconnect when communication is complete. Peer-to-peer networking requires networking software such as Windows 95, Windows for Workgroups or Personal NetWare.

The SA-PC PRO is equipped with two built-in omni-directional antennas located in a hinged housing.

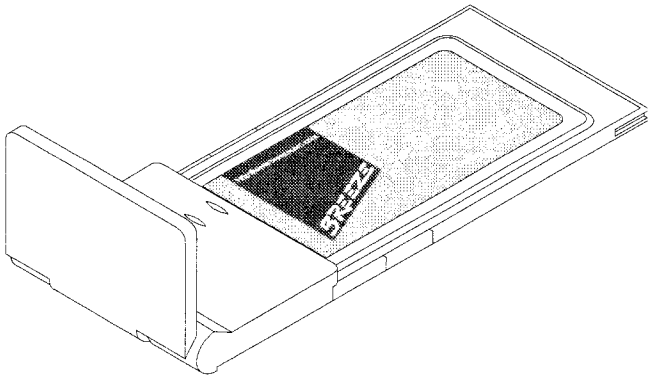


Figure 1.2: The SA-PC PRO Card

1.1.4. SA-40 PRO Four Port Station Adapter

The ***BreezeNET*** SA-40 PRO Four-Port Workgroup Adapter is a wireless LAN adapter that connects a workgroup of up to four Ethernet-equipped workstations to the wireless LAN. The SA-40 PRO is transparent to the workgroup computers' hardware and software.

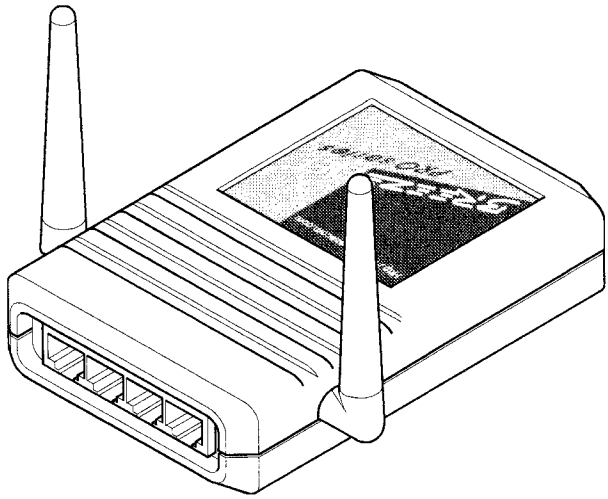
The SA-40 PRO enables connected workstations to communicate with other wireless stations in the same cell coverage area, and to access all network resources such as file servers, printers and shared databases via the ***BreezeNET*** AP-10 PRO Access Point. The SA-40 PRO also allows highly efficient and fast wired communication among the connected workstations.

The ***BreezeNET*** SA-40 PRO contains an embedded SNMP agent and software downloading capabilities which allow it to be effectively managed. Software upgrades are downloaded by TFTP protocol via the Ethernet ports or via the Wireless LAN and Access Point.

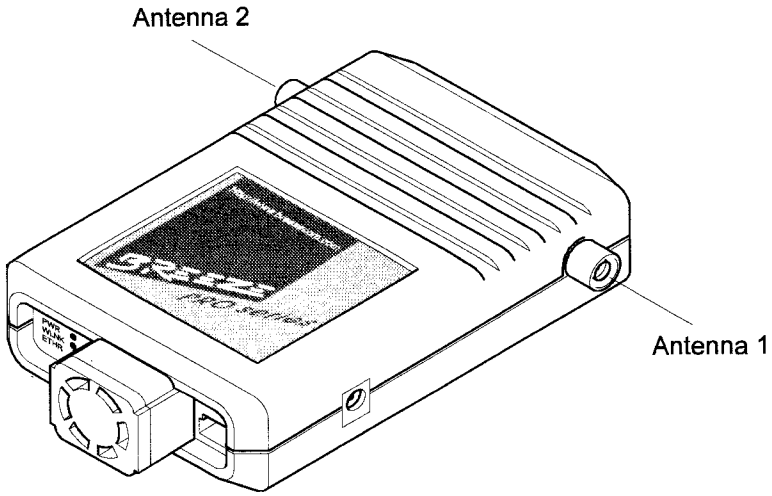
SA-40 PRO Models

The SA-40 PRO is available in two models:

- SA-40 PRO with two built-in omni-directional antennas.



- SA-40D PRO for use with external antenna(s).



1.1.5. WB-10 PRO Wireless Bridge

The ***BreezeNET*** WB-10 PRO is a high-speed, wide-range wireless LAN bridge that provides connectivity to remote Ethernet networks.

The WB-10 PRO communicates with the ***BreezeNET*** AP-10 PRO Access Points of the remote LANs effectively creating an extended wireless network spanning sites situated up to 10 Km apart (in Europe this range is limited by ETSI regulations to 2.5 Km.). In this way a central Ethernet LAN may be connected with one or more branch office LANs.

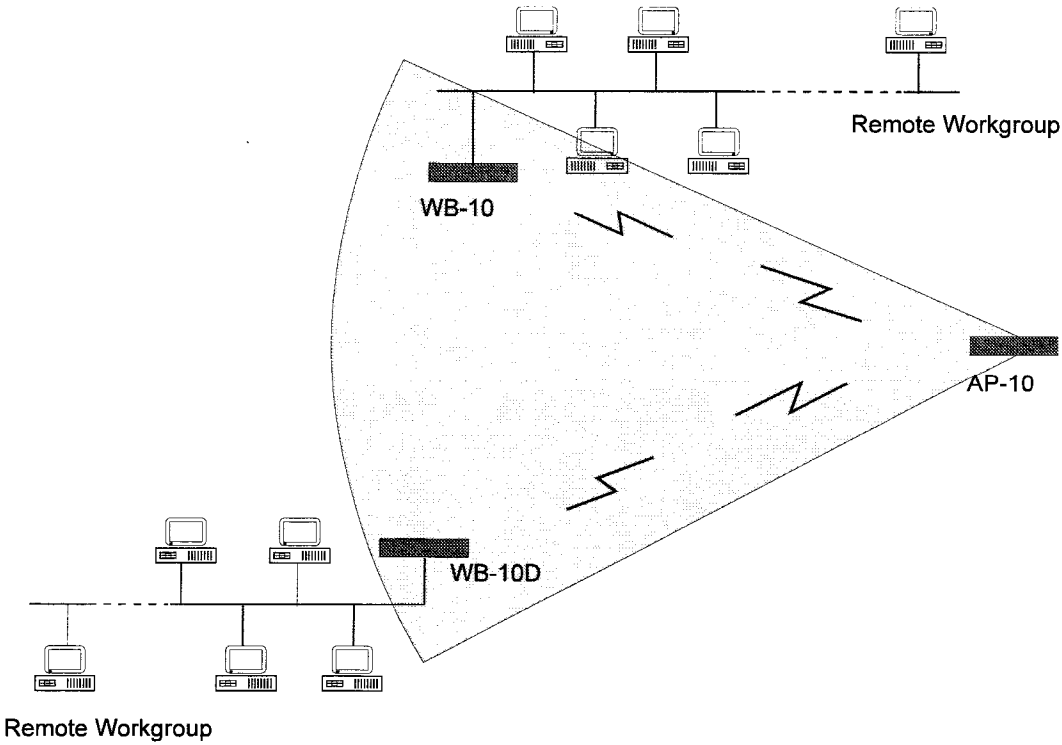


Figure 1.3: Connecting Remote Offices to Main Office Network

The WB-10 PRO also enables connectivity between a wireless LAN and individual workstations or workgroups located outside the LAN. The WB-10 PRO enables these wireless stations in its coverage area to communicate with the wireless LAN and gain access to all of the network resources such as file servers, printers and shared databases.

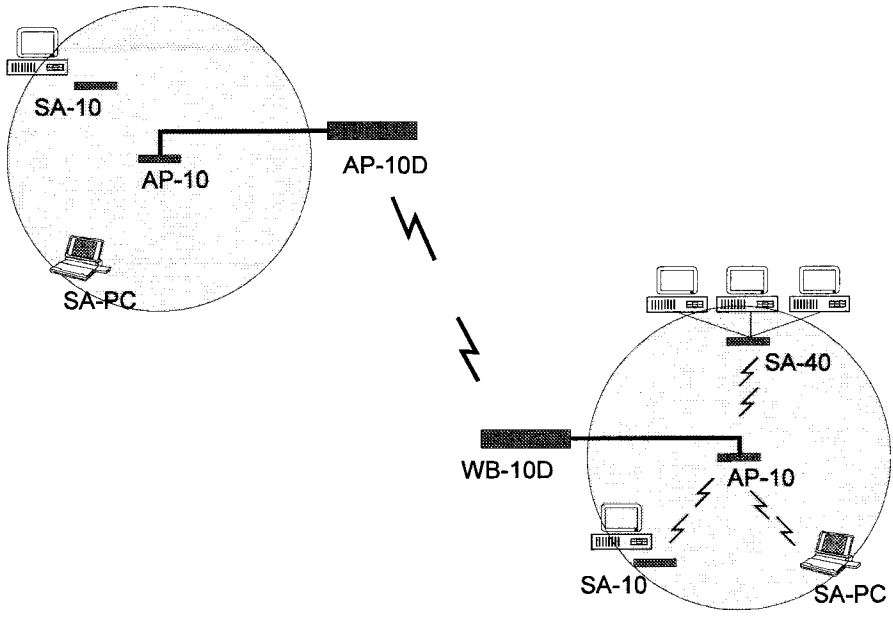


Figure 1.4: Wireless Bridging Between Two or More Wireless LAN Segments

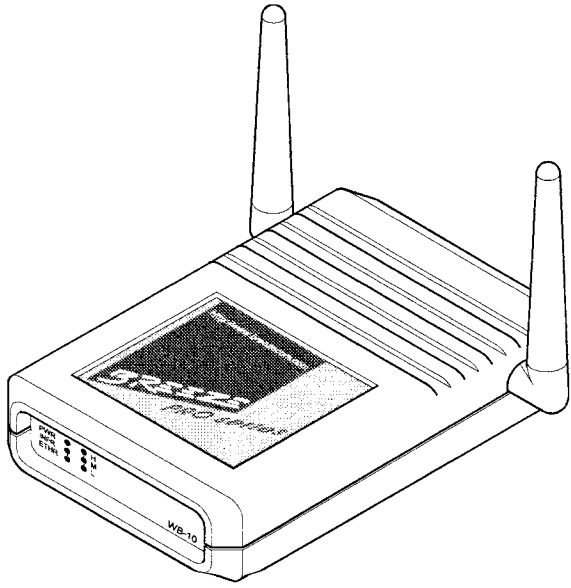
Workstations that can be connected to the wireless LAN include PCs, X-Terminals, Digital, SUN, HP, IBM, and Apple computers. The unit is transparent to the workgroup computers' hardware and software.

The ***BreezeNET*** WB-10 PRO contains an embedded SNMP agent and software downloading capabilities enabling effective management. Software upgrades are downloaded using TFTP protocol via the Ethernet ports or via the wired LAN and Access Point.

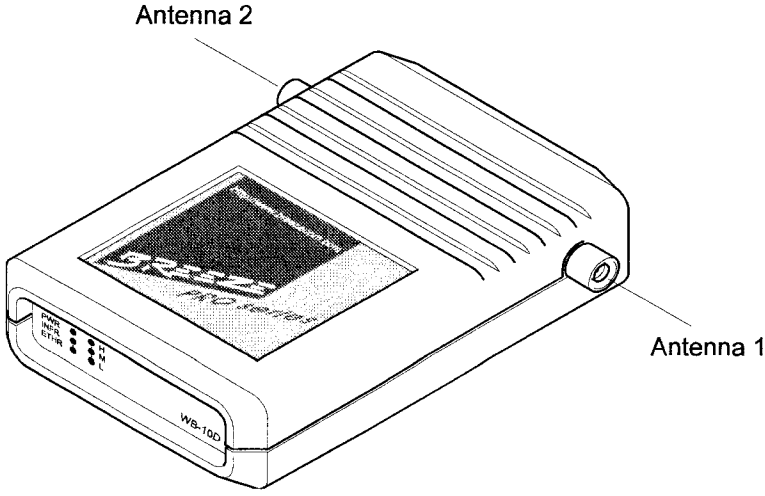
WB-10 PRO Models

The WB-10 PRO is available in two models:

- WB-10 PRO with built-in omni-directional dual antennas.



- WB-10D PRO with two external antenna connector ports.



1.2. Benefits of *BreezeNET PRO* Wireless LANs

Saves cabling costs

The ***BreezeNET PRO*** wireless LAN saves on cabling costs which can amount to up to 40% of your total LAN installation costs.

Plug-and-play installation

No additional software or hardware installation is required. After connecting the units to the power supply and connecting the Access Points to the wired LAN, your ***BreezeNET PRO*** system is operational.

Flexibility

The ***BreezeNET PRO*** wireless LAN provides a high-performance, cost-effective communication solution for:

- Campus environments
- Internet access
- Temporary installations
- Wire elimination in open space offices
- Meeting rooms
- Building-to-building LAN wireless connections
- Points-of-sale
- Exhibitions
- Historical buildings
- Back-up
- Disaster recovery

The ***BreezeNET PRO Series*** is also an ideal solution in environments where mobility is a must, such as:

- Hospitals
- Warehouses
- Airports and other ports of entry

Workstation mobility

Notebook and pen-based computer users can roam throughout the ***BreezeNET PRO*** wireless campus. Users maintain their network connection while roaming from cell to cell. Mobility is seamless as long as the coverage areas overlap.

Quickly extends wired LAN

A ***BreezeNET PRO*** LAN cell gives instant add-on capability to your wired LAN for temporary or permanent expansion.

Technical Advantages

- High data rate of 3 Mbps, with automatic fallback to 2 and 1 Mbps.
- License-free use (2.4GHz ISM band, FHSS)
- 15 Mbps aggregate throughput in the same coverage area using multiple APs (up to 15).
- Antenna diversity and DSP modem ensure robust communication.
- Software, including modem module, upgraded by downloading.
- Spread Spectrum Frequency Hopping and Network ID provides security.
- Simple network management support (SNMP).
- Designed to comply with the upcoming IEEE 802.11 standard.

2. BREEZENET EXTENDED RANGE BRIDGE

Note: These products comply with ETSI 300-328 and can be used only in countries which implement this standard.

2.1. WB-10DE Extended Range Bridge and AP-10DE Extended Range Access Point

The BreezeNET WB-10DE is a high-speed, wide-range wireless LAN bridge that provides connectivity to remote Ethernet networks.

The WB-10DE communicates with the BreezeNET AP-10DE Access Points of the remote LANs effectively creating an extended wireless network spanning sites situated up to 5 Km apart. In this way a central Ethernet LAN may be connected with one or more branch office LANs.

The WB-10DE and AP-10DE products comply with European ETSI standard 300-328. They cannot be used in countries where FCC standards are applicable.

The WB-10DE and AP-10DE can be used as a point-to-point as well as a point-to-multipoint solution.

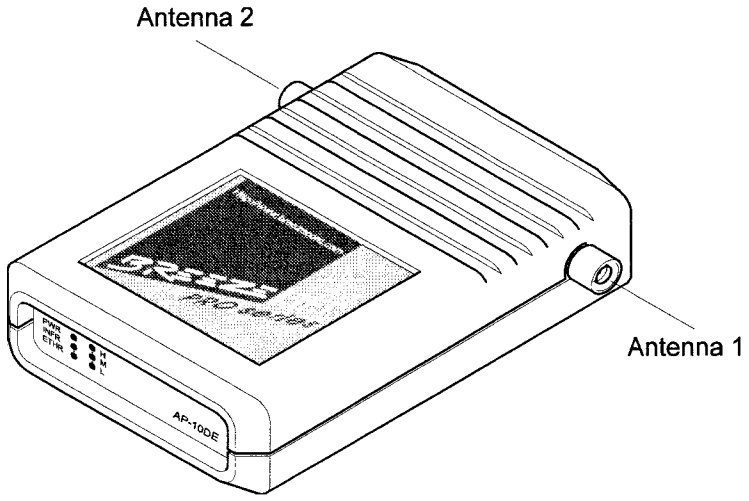
Note: The WB-10DE and AP-10DE are not compatible with the BreezeNET PRO Series. The SA-10 PRO, SA-PC PRO, SA-40 PRO, and WB-10 PRO units cannot communicate with the AP-10DE or the WB-10DE.

The BreezeNET AP-10DE and WB-10 DE contain an embedded SNMP agent and software downloading capabilities enabling effective management. Software upgrades are downloaded using TFTP protocol via the Ethernet ports or via the wired LAN and Access Point.

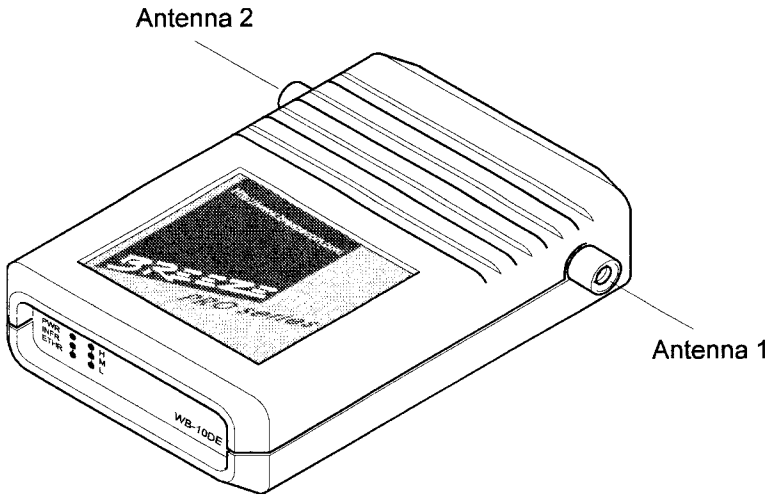
BreezeNET DE Models

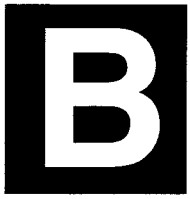
The BreezeNET DE is available in two models:

- AP-10 DE for use with external high-gain antenna(s).



- WB-10 DE with two external antenna connector ports.





SYSTEM

3. System Planning and Configuration

4. System Management

5. System Troubleshooting

3. SYSTEM PLANNING AND CONFIGURATION

3.1. Single Cell Systems

A basic ***BreezeNET PRO*** cell consists of an access point and the wireless workstations associated with it. You can convert most workstations (PCs, X-Terminals, Apple, Digital, SUN, HP, IBM and others) that are equipped with an Ethernet network interface card (NIC) to wireless workstations simply by connecting a ***BreezeNET*** SA-10 PRO Station Adapter. You can convert most laptop computers with a PCMCIA slot into a wireless mobile station by using the SA-PC wireless PC card adapter.

⇒ ***To set up a basic BreezeNET cell:***

1. Position the Access Point (AP-10 PRO) as high as possible and attach to the wall (or, if possible, to the ceiling) using a mounting bracket.You can also place the Access Point on a high stand or shelf.

2. Follow the installation procedures described in "Installing the Access Point", section 7.4."Installing the AP-10 PRO" on page 7-2

3. Install an SA-10 PRO, SA-40 PRO Station Adapter or SA-PC Card on the first workstation you wish to convert to a wireless workstation. Use the LED indicators on the front panel to check received signal quality.

4. Make any necessary adjustments, for example:

   - Adjust the antennas.
   - Adjust the location of the Station Adapter
   - Adjust the location of the Access Point.

5. Proceed to install the next SA-10 PRO, SA-40 PRO Four Port Station Adapter or SA-PC card by repeating steps 3 and 4.

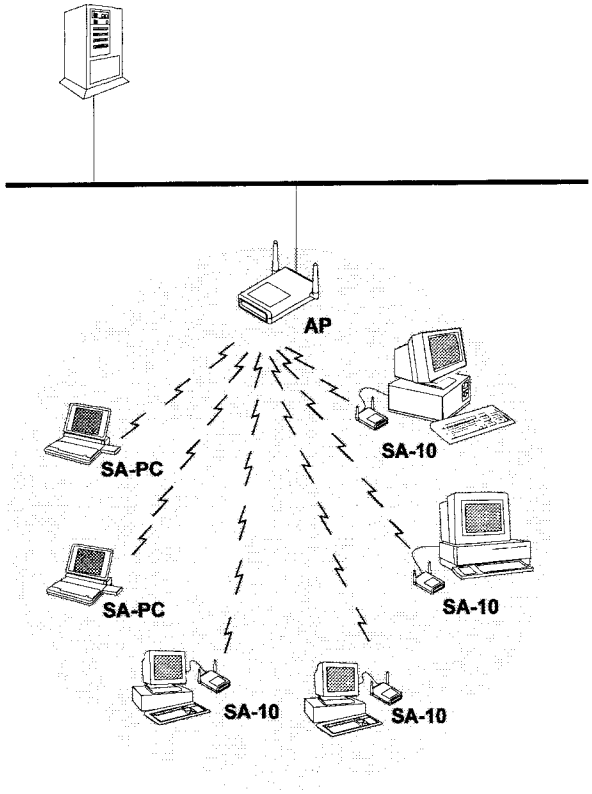


Figure 3.1: The Basic BreezeNET Cell

3.2. Contiguous Cell Systems

When two adjacent Access Points are positioned close enough to each other, a part of the coverage area of Access Point #1 overlaps that of Access Point #2. This overlapping area has two very important attributes:

- Any workstation situated in the overlapping area can communicate with both Access Points #1 and #2.
- Any workstation can move "seamlessly" through the overlapping coverage areas without losing its network connection. This attribute is called *Seamless Roaming*.

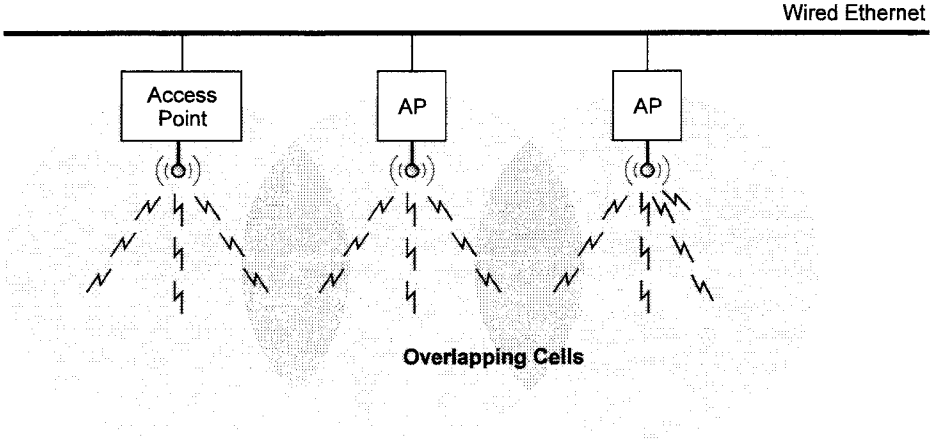


Figure 3.2: Three Overlapping BreezeNET Cells

⇒ ***To set up two overlapping BreezeNET cells:***

1. Install the first Access Point according to the procedure for setting up a single BreezeNET cell. (See: "To set up a basic BreezeNET cell" on page 3-1.)

2. Install the second Access Point so that the two are positioned closer together than the prescribed distance (see section 3.5.2.,"Cell Size"). You can adjust the distance between the Access Points to increase or decrease the size of the overlap area.

3. Adjust the hopping sequence of the second Access Point so that each Access Point has a different hopping sequence. see section 4.1.1.3.1.,"Hopping Sequence"for a detailed description.

4. Set up a wireless workstation by installing a Station Adapter (SA-10 PRO, SA-40 PRO or SA-PC card). See "Installing the Station Adapter" in the appropriate sections. Position the wireless workstation at a point approximately equidistant from the two Access Points.

5. Temporarily disconnect the second Access Point from the power supply. Verify radio signal reception from the first Access Point. Use the LED indicators on the front panel of the Station Adapter to

check received signal strength.

6. Disconnect the first Access Point from the power supply and re-connect the second Access Point.Verify radio signal reception at the second Access Point. Use the LED indicators on the front panel of the Station Adapter to check received signal strength. Signal strength should be in the medium to high range.

7. Adjust the distance between the Access Points if necessary. The coverage areas should overlap.

8. Continue setting up overlapping cells until the required area is covered.

Note: *Access Points continuously transmit signals (beacon frames) whether they are connected to an Ethernet backbone or not.*

3.3. Multicell Configuration

Areas congested by many users and a heavy traffic load may require a multicell structure. In a multicell structure, several Access Points are installed in the same location. Each Access Point has the same coverage area, thereby creating a common coverage area which increases aggregate throughput. Any workstation in the overlapping area can communicate with any Access Point covering that area.

Note: *Each co-located Access Point in a multicell configuration should have a different hopping sequence. Make sure to configure each AP accordingly.*

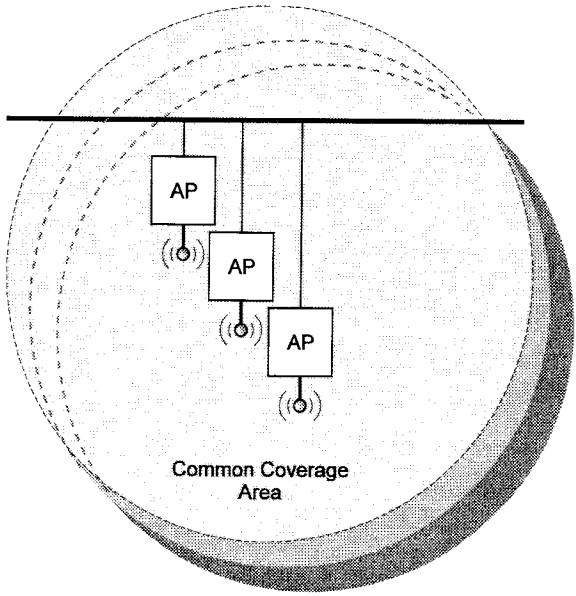


Figure 3.3: Multicell Structure

The aggregate throughput of the common coverage area can be calculated as the number of co-located Access Points multiplied by the throughput of each individual Access Point minus the degradation caused by the interference among the different Access Points.

Each Access Point can transmit up to 3 Mbps and can support a net throughput of 1.7 Mbps. To calculate the required aggregate throughput, multiply the number of active users by the required throughput per user. To estimate the required number of Access Points, divide the total required throughput by the throughput per Access Point.

Turn on the Load Sharing option (4.1.1.3.6.) in order to divide the stations equally among the Access Points. Stations inside the common coverage area will then automatically associate with an Access Point that is less loaded and provides better signal quality.

3.4. Multi-hop Configuration

In areas where a wired LAN backbone is not available, an AP and a WB can be paired and used to distribute a wireless backbone. In this way, the range of a wireless system can be extended by using such an AP-WB pair as a

repeater. This is also useful when you want to connect two sites between which a line-of-sight does not exist. Another AP-WB pair can be positioned at a third location where line-of-sight exists with each of the original locations. This third location then acts as a relay point. System configuration is as follows:

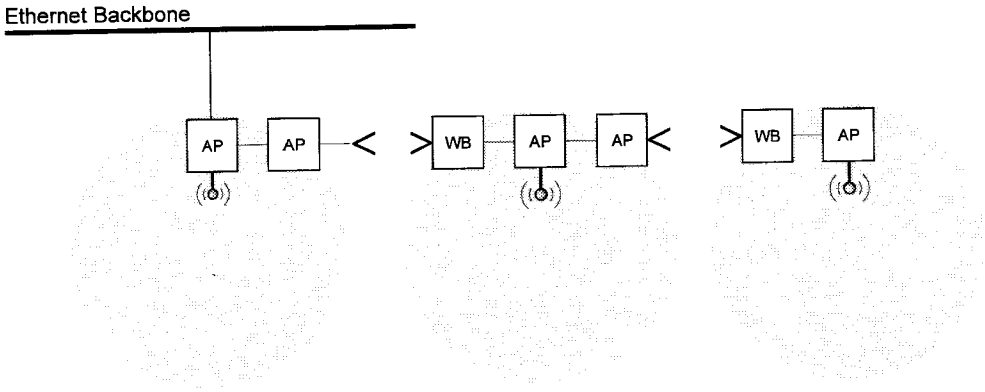


Figure 3.4: Multihop Configuration

Each AP-WB pair should have its own unique ESSID to prevent the WB from associating with the wrong Access Point. As always, assign different hopping sequences to each AP to minimize interference among them.

3.5. Coverage Considerations

When planning the coverage areas of ***BreezeNET PRO*** cells, the following factors should be taken into consideration:

3.5.1. Construction Materials

A cell's coverage area is affected by the construction materials of the walls, partitions, ceilings, floors and the furnishings of the cell. Due to their intrinsic nature, these materials may cause radio signal loss:

- Metal objects reflect radio signals.They do not let the signals pass through.
- Wood, glass, plastic and brick reflect part of the radio signals and allow

part of the radio signals to pass through.

- Water and objects containing much moisture absorb a large part of the radio signals.

Table 1: Signal Loss Chart

Obstruction	Additional Loss (dB)	Effective Range	Approx. Range
Open Space	0dB	100%	1000ft.
Window (non-metallic tint)	3dB	70%	700ft. (215m)
Window (metallic tint)	5-8dB	50%	500ft. (150m)
Light Wall (dry wall)	5-8dB	50%	500ft. (150m)
Medium Wall (wood)	10dB	30%	300ft. (100m)
Heavy Wall (solid core 6")	15-20dB	15%	150ft. (50m)
Very Heavy Wall (solid core 12")	20-25dB	10%	100ft. (30m)
Floor/Ceiling (solid core)	15-20dB	15%	150ft. (50m)
Floor/Ceiling (heavy solid core)	20-25dB	10%	100ft. (30m)

Note: *Take stairwells and elevator shafts into consideration when positioning Access Points. There is no way to quantify the loss associated with these obstructions, however they do have an effect on the signal.*

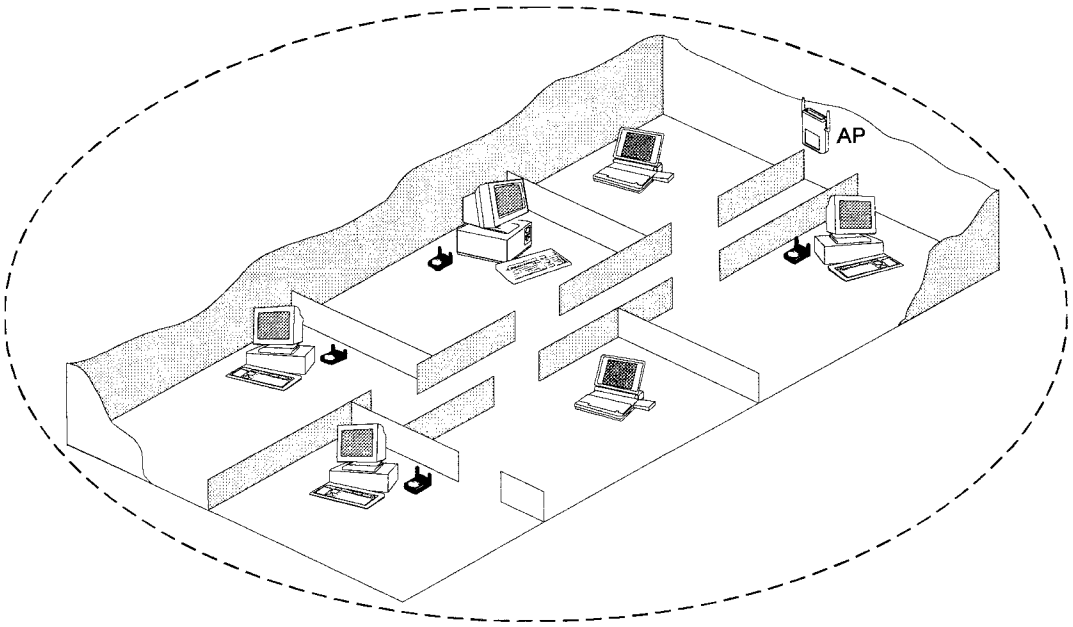


Figure 3.5: BreezeNET LAN in a typical office environment

3.5.2. Cell Size

Cell size is determined by the maximum possible distance between the Access Point and the Station Adapter.This distance varies according to the building floor plan, whether the cell is located in an outdoor or indoor environment, and the nature of that environment. There are four general categories:

Open Indoor Areas

Open office areas with no partitioning and no obstacles between the Access Point and the BreezeNET workstation.

The suggested maximum distance between Access Point and workstation:

Standard AP-10 PRO:.....200m (600 ft.)

Semi-Open Indoor Areas

Open-plan offices partitioned into individual workspaces, factory floor areas, warehouses, etc.

The suggested maximum distance between Access Point and workstation:

Standard AP-10 PRO ..... 100m (300 ft.)

Closed Indoor Areas

A floor divided into individual offices by concrete, masonry or sheet-rock walls; or a house.

The suggested maximum distance between Access Point and workstation:

Standard AP-10 PRO ..... 50m (150 ft.)

Open Outdoor Areas

Open outdoor areas with an unobstructed line of sight between the Access Point and the BreezeNET PRO workstation.

The suggested maximum distance between Access Point and workstation:

Standard AP-10 PRO ..... 700m (2000 ft.)

AP-10D PRO with external antennas ..... up to 10Km (7 miles) in the USA

..... up to 2.5Km in Europe

Note: *The maximum distance of 10Km/7 miles is achieved using 24 dBi antennas.The maximum distance of 2.5Km is achieved using 18 dBi antennas.*

3.6. BreezeNET PRO Range Tables

The range values provided in the following table refer to 1,2,and 3 Mbps, respectively. These ranges are attained under good propagating conditions when using the standard cables supplied in the antenna set. Actual ranges may vary due to specific multipath and interference conditions.

Outdoor installations must have line-of-sight. Solid obstacles such as buildings or hills prevent the establishment of a link. Partial obstacles such as trees or traffic reduce range. Extending coaxial cables causes an increase in assembly signal loss and reduces range.

For specific range guidelines and information about extending cables, consult your dealer or BreezeCOM.

USA Range Tables

Table 2: BreezeNET USA/FCC Range Table - 1 Mbps

Antenna Type		Omni-2	Omni-6	Omni-7.2	Uni-8.5	Uni-12	Uni-18	Uni-24
	Assembly Gain	2dBi	5dBi	6dBi	6.5dBi	10dBi	15dBi	19dBi
Omni-2	2dBi	3000 ft.	3800 ft.	3900 ft.	4000 ft.	1.1 miles	1.5 miles	1.9 miles
Omni-6	5dBi	3800 ft.	4300 ft.	4600 ft.	4800 ft.	1.3 miles	1.8 miles	2.2 miles
Omni-7.2	6dBi	3900 ft.	4600 ft.	4800 ft.	5000 ft.	1.4 miles	1.9 miles	2.3 miles
Uni-8.5	6.5dBi	4000 ft.	4800 ft.	5000 ft.	1.1 miles	1.5 miles	2 miles	2.4 miles
Uni-12	10dBi	1.1 miles	1.3 miles	1.4 miles	1.5 miles	2 miles	2.5 miles	3 miles
Uni-18	15dBi	1.5 miles	1.8 miles	1.9 miles	2 miless	2.5 miles	3.5 miles	4 miles
Uni-24	19dBi	1.9 miles	2.2 miles	2.3 miles	2.4 miles	3 miles	4 miles	6 miles

Table 3: BreezeNET USA/FCC Range Table - 2 Mbps

Antenna Type		Omni-2	Omni-6	Omni-7.2	Uni-8.5	Uni-12	Uni-18	Uni-24
	Assembly Gain	2dBi	5dBi	6dBi	6.5dBi	10dBi	15dBi	19dBi
Omni-2	2dBi	1500 ft.	2000 ft.	2100 ft.	2200 ft.	0.7 mile	1 mile	1.1 miles
Omni-6	5dBi	2000 ft.	2400 ft.	2700 ft.	2900 ft.	0.9 mile	1.2 miles	1.3 miles
Omni-7.2	6dBi	2100 ft.	2700 ft.	2900 ft.	3000 ft.	0.9 mile	1.3 miles	1.4 miles
Uni-8.5	6.5dBi	2200 ft.	2900 ft.	3000 ft.	0.6 mile	0.9 mile	1.3 miles	1.4 miles
Uni-12	10dBi	0.7 mile	0.9 mile	0.9 mile	0.9 mile	1 mile	1.4 miles	1.8 miles
Uni-18	15dBi	1 mile	1.2 miles	1.3 miles	1.3 miles	1.4 miles	2 miles	2.5 miles
Uni-24	19dBi	1.1 miles	1.3 miles	1.4 miles	1.4 miles	1.8 miles	2.5 miles	3.5 miles

Table 4: BreezeNET USA/FCC Range Table - 3 Mbps

Antenna Type		Omni-2	Omni-6	Omni-7.2	Uni-8.5	Uni-12	Uni-18	Uni-24
	Assembly Gain	2dBi	5dBi	6dBi	6.5dBi	10dBi	15dBi	19dBi
Omni-2	2dBi	500 ft.	800 ft.	900 ft.	950 ft.	0.3 mile	0.6 mile	0.6 mile
Omni-6	5dBi	800 ft.	900 ft.	1000 ft.	1000 ft.	0.4 mile	0.7 mile	0.7 mile
Omni-7.2	6dBi	900 ft.	1000 ft.	1000 ft.	1000 ft.	0.4 mile	0.7 mile	0.8 mile
Uni-8.5	6.5dBi	950 ft.	1000 ft.	1000 ft.	0.2 mile	0.4 mile	0.7 mile	0.8 miles
Uni-12	10dBi	0.3 mile	0.4 mile	0.4 mile	0.4 mile	0.5 mile	0.9 miles	1 mile
Uni-18	15dBi	0.6 mile	0.7 mile	0.7 mile	0.7 mile	0.9 mile	1.1 miles	1.4 miles
Uni-24	19dBi	0.6 mile	0.7 mile	0.8 mile	0.8 mile	1 mile	1.4 miles	1.8 miles

- Range figures assume line-of-sight with sufficient clearance between the antennas. These figures may vary according to specific multipath and interference situations.
- Maximum range can be increased by using two antennas per unit and a low-noise amplifier such as the LNA 10 (see section 15.,"Accessories").

Europe Range Tables

Table 5: BreezeNET Range Table - Europe (recommended)

Antenna Set	Cable Length (m)	Cable Type	Antenna Type	Range 3 Mbps	Range 2 Mbps	Range 1 Mbps
Omni-6	3	RG58	6	100m	250m	600m
Uni-8.5	6	RG58	8.5	100m	250m	600m
Uni-18/10	10	Heliax	18	500m	1000m	2500m
Uni-18/15	15	Heliax	18	450m	850m	2000m
Uni-18/20	20	Heliax	18	400m	700m	1800m

Table 6: BreezeNET Range Table - Europe (maximum)

Antenna Type	Range 3 Mbps	Range 2 Mbps	Range 1 Mbps
6	200m	400m	1000m
8.5	200m	400m	1000m
18	700m	1500m	3000m

Table 7: BreezeNET AP-10DE and WB-10DE Range Table (recommended)

Antenna Set	Cable Length (m)	Cable Type	Antenna Type	Range 3 Mbps	Range 2 Mbps	Range 1 Mbps
Uni-24/10	10	Heliax	22	1200m	2000m	5000m
Uni-24/15	15	Heliax	22	1000m	1500m	4000m
Uni-24/20	20	Heliax	22	900m	1400m	3500m

Table 8: BreezeNET AP-10DE and WB-10DE Range Table - Europe (maximum)

Antenna Type	Range 3 Mbps	Range 2 Mbps	Range 1 Mbps
24	1500m	3000m	8000m

Note: The antenna sets Uni-24/10, Uni-24/15 and Uni 24/20 are for use with AP-10DE and B-10DE models only. These antenna sets include a 24 dBi antenna plus filter (FL0051) and 10, 15 and 20 m Heliax cables, respectively.

Note: Maximum range is achieved when there is a clear line of sight between antennas.

Specifications are subject to change without notice.

3.7. Antenna Selection

Selecting the antenna that best suits your networking needs is a very important procedure that has a critical effect on system performance. The first consideration is your system's specific application.

3.7.1. Indoor applications

For most indoor applications, the best choice is the standard unit equipped with built-in 2dBi antennas. The units are small, easy to install and cover a large area (see section 3.5.,"Coverage Considerations").

If an extended range is required, use the AP-10D with external, higher gain antennas. The antenna best suited for most indoor applications is the Omni-6. It is omni-directional, has a 4 ft. cable and is easily mounted on a wall. The Uni-8.5 is also useful in indoor applications. It is very small and easily wall-mounted, but its radiation pattern is limited (75°).

BreezeCOM recommends that, for indoor applications, you use two antennas per unit to utilize the diversity gain of the system.

3.7.2. Outdoor Applications

Point-to-Point

Point-to-Point installations require directional antennas at either end of the link. (For a description of available directional antennas, see section 14., Antennas and Cables.) To select the best antenna for a specific application, consider the following factors:

- Distance between sites
- Required throughput
- Clearance between sites
- Cable length.

Refer to the range tables in section 3.6. to determine the best combination of antennas for your application.

Point-to-Multipoint

Point-to-Multipoint applications consist of one or more APs at the central site and several remote bridges (SA-10, WB-10). In this case, use an Omni-6 antenna with the Access Point because of its 360° radiation pattern.

In the United States, the Omni-7.2 antenna (which also has a 360° radiation pattern but has a wider range) can also be used. The Omni-7.2 antenna comes with a 20ft. low loss cable and a mast mount bracket for rooftop installations. The remote units should use directional antennas aimed in the direction of the AP's antenna(s).

3.7.3. Mobile Applications

In mobile applications, station orientation changes continuously. In order to maintain connectivity throughout the entire coverage area, most mobile applications require omni-directional antennas for both access points and wireless stations. In a motor vehicle, for example, you can install an SA-10 in the cabin, and mount the antennas (in most cases an Omni-6) on the roof.

See section 14., "Antennas and Cables" for a complete description of all antennas available for use with the ***BreezeNET PRO Series***.

3.8. Outdoor Installation Considerations

The ***BreezeNET PRO Series*** can be used in point-to-point or point-to-multipoint configurations. Each point-to-point link is based on the use of one Access Point (AP-10D model with external antennas) and one adapter (WB-10D or SA-10/40D). The AP and the WB must be equipped with one or two directional antennas. The necessary antenna gain depends on the required range and performance.

Setting up a point-to-multipoint link requires the use of an AP-10D equipped with omni-directional antennas and a remote WB-10D (or SA-10/40D) equipped with high-gain directional antennas.

3.8.1. Site Selection Factors

When selecting a location for external antennas, remember to take into consideration the following guidelines:

- Minimum distance between sites
- Maximum height above the ground
- Maximum line of sight clearance
- Maximum separation between antennas (diversity option)

Path of Clearest Propagation

A propagation path is the path signals traverse between the antennas of any two bridges. The "line" between two antenna sites is an imaginary straight line which may be drawn between the two antennas. Any obstacles in the path of the "line" degrade the propagation path. The best propagation path is, therefore, a clear line of sight with good clearance between the "line" and any physical obstacle.

Physical Obstacles

Any physical object in the path between two bridges causes signal attenuation. Common obstructions are buildings and trees. If a bridge's antenna is installed indoors, the walls and/or windows between the two sites are physical obstructions. If the antenna is positioned outdoors, any buildings

or other physical construction; trees, mountains or other natural geographic features higher than the antenna and situated in the path between the two sites constitute obstructions.

Install indoor antennas as close as possible to a window (or wall if a window is not accessible) facing the required direction. Avoid metal obstacles such as metal window frames or metal film anti-glare windows in the transmission path. Install outdoor antennas high enough to avoid any obstacles which may block the signal.

Minimal Path Loss

Path loss is determined mainly by two factors:

- Distance between sites

  Path loss is lower and system performance better when distances between sites are shorter.

- Antenna height

  Path loss is lower when antennas are positioned higher. Antenna height is the distance from the imaginary line connecting the antennas at the two sites to "ground" level. "Ground" level in an open area is the actual ground. In dense urban areas, "ground" level is the average height of the buildings between the antenna sites.

3.8.2. Antenna Alignment

Low gain antennas do not require alignment due to their very wide radiation pattern. High gain antennas have a narrow beamwidth necessitating an alignment procedure in order to optimize the link.

Check antenna alignment by using the LED indicators on the front panel of whichever adapter is used in the link (WB-10D or SA-10/40D). These LED provide indication of reception quality.

⇒ ***To perform antenna alignment:***

1. Assemble antennas according to the assembly instructions included with the antenna set.

2. Mount the antennas as high as possible.

3. Connect the coaxial cable to the AP at the main site.

4. Connect the coaxial cable to the WB (or SA) at the remote site.

5. Power on the AP and the WB (or SA).

6. Synchronize the units by aligning the antennas manually until the WLNK indicator LED on the front panel of the Wireless Bridge and/or Station Adapter illuminates.

7. Align antennas at the main and remote sites until maximum signal quality is obtained. (Check QLT LEDs on the front panel of the Station Adapter and the Wireless Bridge.)

If the received signal quality is lower than expected for this antenna/range combination, change antenna height and verify RF cables connections.

3.8.3. Antenna Diversity

In applications where no multipath propagation is expected, a single antenna is sufficient to ensure good performance levels. However, in cases where multipath propagation exists, BreezeCOM recommends that two antennas be used. This takes advantage of space diversity capabilities. By using two antennas per unit, the system can select the best antenna on a per-packet basis (every several milliseconds).

Multipath propagation is to be expected when there are potential reflectors between the main and remote sites. These reflectors may be buildings or moving objects such as airplanes and motor vehicles. If this is the case, the radio signal does not travel in a straight line, but is reflected or deflected off of the object, creating multiple propagation paths.

When installing a single antenna, modify the "transmit diversity" option to either antenna 1 or antenna 2, according to the antenna being used. (see section 4.1.1.3.4.,"Transmit Diversity")

3.8.4. Antenna Polarization

Antenna polarization must be the same at either end of the link. In most

applications, the preferred orientation is vertical polarization. Above-ground propagation of the signal is better when it is polarized vertically. To verify antenna polarization, refer to the assembly instructions supplied with the antenna set.

3.9. Site Survey

3.9.1. Pre-Installation Site Survey

Use Site Survey to verify an installation and to determine that you have chosen the best location for an Access Point to ensure the best possible performance.

Performing Site Survey using the Quality Indicator LEDs

You can perform Site Survey by using the Quality Indicator LEDs located on the front panels of the SA-10, SA-40 and WB-10 and the Load LEDs located on the front panel of the AP-10. The LEDs provide a good indication of received signal strength and are usually sufficient to verify antenna installation.

There are three LEDs indicating three levels of received signal strength quality; L (Low), M (Medium), and H (High). When none of the LEDs are lit up, this indicates very low-quality signal reception. When the Low (L) LED is lit, this indicates low-quality signal reception. When both the Medium (M) and Low (L) LEDs are lit, this indicates medium-quality reception. When all three LEDs are lit, this indicates high-quality reception.

When running Site Survey software and the AP-10 is configured as the receiver, the LOAD LEDs function in the same way as the QLT LEDs in the other units and can be used to check the signal level received by the AP-10 (see section 4.1.3.2.,"Survey Software menu").

Performing Pre-Installation Site Survey using Survey Software

Verifying antenna alignment using the QLT LEDs is usually sufficient to acheive satisfactory results. In special cases , use Site Survey software to perform pre-installation Site Survey in order to fine-tune antenna alignment and to verify optimum wireless performance. Access Site Survey software from Local Terminal Management (see section 4.1.3.2.).

3.9.2. Post-Installation Site Survey

You can use the following Site Survey procedure as another tool to check link performance between two BreezeNET PRO units after installation has been completed.

⇒ ***To perform post-installation site survey:***

1. Verify synchronization of the link between the unit being tested and the other unit.
2. Make sure that there is an exchange of Ethernet frames between the two units.
3. Reset the system counters (see section 4.1.3.1.2.,"Reset Counters").
4. After a few minutes, check the statistics that appear in the Display Counters screen on the monitor (see section 4.1.3.1.1.,"Display Counters").
5. The ratio between the Total retransmitted fragments and the Total transmitted frames (bridge) should not exceed 1:10 (10%).
6. Frames Dropped (too many retries) should not exceed 2.5% of Total transmitted frames (bridge).

Access the Rate Counters screen to verify the rate at which the unit is operating.

⇒ ***To access the Rate Counters screen:***

1. Connect the unit to a local monitor as described in section 4.1., "Local Terminal Management".
2. From the BreezeNET Monitor main screen, select option (2), "Advanced Settings".
3. From the Advanced Settings menu, select option (5), "Rate".

4. From the Rate menu, select option (3), "Rate Counters".

```
BreezeNET PRO Series (SA-10)
Beta Version - $Revision:    3.209  $
$Date:  23 Feb 1997 17:34:16  $
Rate menu
=========
1 - Multi-Rate Support
2 - Multi-Rate Decision Window Size
3 - Rate Counter
Select option >
MOD=0x1F. EV=0x110. SVR=0x00. Aged out 0 FDB entries
3


Data tx on rates 1Mb: 0; 2Mb: 0; 3Mb: 0; Ret: 0


  Hit any key to return >
```

Figure 3.6: Rate Menu with Rate Counters Displayed

This screen displays how many frames have been transmitted at each of the possible rates (1, 2, and 3 Mbps). The rate displaying the largest amount of transmitted frames is the predominant rate at which the unit operates.

3.10. Versions Compatibility

The ***BreezeNET PRO Series*** incorporates all changes made in the IEEE 802.11 specifications since BreezeNET was first released. The new product line takes advantage of all these changes to deliver vastly superior performance, reliability, flexibility and functionality.

If you are adding ***BreezeNET PRO Series*** equipment to an existing ***BreezeNET*** wireless network, you need to upgrade all individual units installed on the network to version 3.x.

If you have purchased the SA-PC Card, upgrade any BreezeNET equipment to the new 3.x software release if it will be transmitting and receiving from stations equipped with the ***BreezeNET PRO*** SA-PC Card.

4. SYSTEM MANAGEMENT

4.1. Local Terminal Management

The ***BreezeNET PRO Series*** is designed as a plug-and-play solution and operates without any user intervention. However, users who want to modify default setup parameters to adapt the system to their own particular needs can do so by utilizing local terminal management procedures.

The local monitor enables you to access ***BreezeNET PRO*** setup parameters on all units from an ASCII ANSI terminal or from a PC by using a terminal emulation program such as Windows95 HyperTerminal or Procomm.

When using a PC terminal emulation program, configure as follows:

Baud rate 9600
Data bits 8
Stop bits 1
Parity ..... None
Flow Control ..... None
Connector ..... Available Com port

⇒ ***To access setup functions with a local monitor:***

1. Connect the special monitor cable supplied with the AP to the unit's MON port. The monitor cable can be used with all products in the ***BreezeNET PRO Series***. The MON port is located on the rear panel of AP-10, SA-10 and WB-10 models. It is located on the front panel of the SA-40.

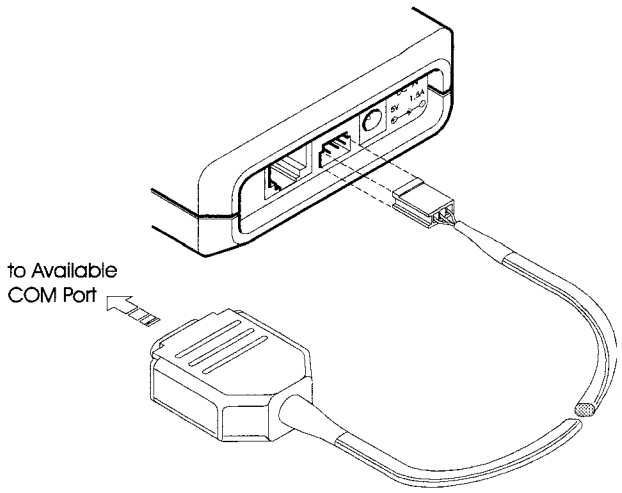


Figure 4.1: Connecting the unit to the monitor

2. Connect the other end of the cable to the PC serial port (COM port).

3. Press <ENTER>.The ***BreezeNET PRO*** monitor appears displaying the main screen for the unit you want to configure.

```
BreezeNet PRO Series (SA-10)
Official Version - $Revision: 3.2  $
$Date:  19 Feb 1997 16:32:32 $
 BreezeNet Monitor
 =================
1 - System Configuration
2 - Advanced Settings
3 - Site Survey
4 - Access Control
Select option >
```

Figure 4.2: The BreezeNET PRO Main Screen

When you first access local terminal management, the ***BreezeNET PRO*** unit's main menu is displayed. This menu gives access to the following sub-menus:

- System Configuration menus

- Advanced Settings
- Site Survey
- Access Control

To configure the unit, use the System Configuration menus. Use Site Survey menus for more accurate site survey and for troubleshooting. The System Administrator can use the Access Control menus to limit access to the configuration menus. Only BreezeCOM technicians are authorized to make any changes to the parameters accessed through the Advanced Settings menus.

⇒ ***To access sub-menus and modify parameter values:***

When connecting a powered off unit to a terminal for configuration, power on to automatically access the main screen. If the unit is already powered on, the last screen displayed appears. Press ESC as many times as necessary to reach the main screen.

1. Type the number that appears next to the menu option to access the required sub-menu.

2. To return to the previous menu at any stage, press **Esc**.

3. Reset the unit after modifying configurations for the changes to take effect.

You can move through all Setup sub-menus by using these procedures and following the instructions that appear on the screen.

List of Screens

4.1.1. System Configuration Menus

```
BreezeNet PRO Series (SA-10)
Official Version - $Revision:   3.2  $
$Date:  17 Feb 1997 17:30:46  $
System Configuration
====================
1 - Station Status
2 - IP and SNMP Parameters
3 - Wireless LAN Parameters
4 - Bridging
5 - Station Control
Select option >
```

Figure 4.3: The BreezeNET PRO System Configuration Menu

⇒ ***To access the System Configuration Menu:***

In the main menu, type `1` at the cursor. The System Configuration menu appears.

The System Configuration menus enable the user to access and configure the following parameters:

- Station Status
- IP and SNMP Parameters
- Wireless LAN Parameters

- Bridging
- Station Control

4.1.1.1. Station Status

```
Unit's Mode:            Station
Unit's HW Address:      00-20-D6-02-41-FE
Unit's WLAN Address:    00-20-D6-02-41-FE
Station Status: SCANNING


AP Address:          FF-FF-FF-FF-FF-FF
Total Number of Associations since last reset 0
  Hit any key to return >
```

Figure 4.4: The Station Status Screen

4.1.1.1.1. Station Status Configuration Parameters

Station Status is a read-only screen that displays the current values of the following parameters:

Unit Mode

This field identifies the unit's function. In this case, the unit is functioning as a station. If the unit is an Access Point, "AP" appears in this field.

Unit H/W Address

Displays the BreezeNET PRO products unique IEEE MAC address.

Unit WLAN Address

Displays the learned address of the attached PC or workstation in the SA-10 PRO. The unit adopts this address as its wireless LAN MAC address. This field does not appear when the unit is an AP. SA-40 and WB-10 units use the H/W address as the WLAN address.

Station Status

There are three options:

Scanning - A unit functioning as a station is searching for an AP to associate

with.

Sync Waiting for Address - The BreezeNET PRO unit functioning as a station is synchronized with an AP but has not yet learned its WLAN MAC address (this option is relevant only to the SA-10).

Associated - The unit is synchronized with an AP and has adopted the attached PC MAC address (SA-10) or uses the unit's H/W address (SA-40 and WB-10).

This field does not appear when the unit is an AP.

AP Address

The address of the AP with which the unit is currently associated.

This field is irrelevant when the unit being configured is an AP.

Total Number of Associations

This indicates the total number of associations and disassociations with various APs. This is usually an indication of roaming.

When the unit being configured is an AP, this field indicates how many station are currently associated with this particular AP.

4.1.1.2. IP and SNMP Parameters

```
BreezeNet PRO Series (SA-10)
Official Version - $Revision:   3.2  $
$Date:  17 Feb 1997 17:30:46  $
IP and SNMP Parameters menu
===========================
1 - IP Address
2 - Subnet Mask
3 - Default Gateway Address
4 - SNMP Traps
5 - Display Current Values
Select option >
```

Figure 4.5: The IP and SNMP Parameters Menu

All BreezeNET PRO units contain IP Host software. This software is used for testing the unit for SNMP management functions and for downloading software using the TFTP protocol.

Assign an IP address only if you want to ping the unit, remotely manage using SNMP or download new software using TFTP.

Set IP addresses and subnet masks using standard IP address notation (four bytes separated by periods). When accessing a host belonging to a different subnet, the ***BreezeNET PRO*** unit sends the traffic through the default IP gateway. If such access is required, specify the gateway IP address.

⇒ ***To access IP Parameters:***

1. In the System Configuration menu, type 2 at the cursor. The IP menu appears displaying the following options:

   - IP Address
   - Subnet Mask
   - Default Gateway Address
   - SNMP Traps
   - Display Current Values.

2. At the select option prompt, type the number of the required option. The dialog box for that option appears.

4.1.1.2.1. IP Address

```
Value in non volatile ram:
Bridge port -
  Hex format.      Ip address: 0x00000000
  Decimal format. Ip address: 000.000.000.000

IP Address :

  Enter 4 groups of 3 digits separated by dots

    >
```

Figure 4.6: The IP Address Screen

⇒ ***To modify the IP address:***

Type in the required IP address according to the format described in the dialog screen.

4.1.1.2.2. Subnet Mask

```
Value in non volatile ram:
Bridge port -
  Hex format.      Ip mask    : 0x00000000
  Decimal format.  Ip mask    : 000.000.000.000

Subnet Mask :

  Enter 4 groups of 3 digits separated by dots

  >
```

Figure 4.7: The Subnet Mask Dialog Screen

⇒ ***To modify the subnet mask:***

Type in the required subnet mask according to the format described in the dialog screen.

4.1.1.2.3. Default Gateway Address

```
Value in non volatile ram:
Default gateway -
  Hex format.      Ip address: 0x00000000
  Decimal format.  Ip address: 000.000.000.000

Default Gateway Address:

  Enter 4 groups of 3 digits separated by dots

  >
```

Figure 4.8: The Default Gateway Address Screen

⇒ ***To modify the gateway address:***

Type in the required gateway address according to the format described in the dialog screen.

4.1.1.2.4. SNMP Traps

A trap is an SNMP frame sent to intercept certain defined events. When the event occurs, the trap frame reports the event to the defined host address. You can configure the host address to which the traps are sent through

SNMP management. (See section 4.2., "SNMP Management" on page 4-40.)

The following trap types are defined in the system:

- brzAProamingInTRAP TRAP-TYPE
  ENTERPRISE breezecom
  VARIABLES}
  brzTrapSTAMacAddr

  This trap indicates that a station has roamed into this AP coverage area. It contains the MAC address of the associated station.

- brzAPassociatedTRAP TRAP-TYPE
  ENTERPRISE breezecom
  VARIABLES}
  brzTrapSTAMacAddr

  This trap indicates that a new station is associated with this AP. It contains the MAC address of the associated station.

- brzAPdisassociatedTRAP TRAP-TYPE
  ENTERPRISE breezecom
  VARIABLES}
  brzTrapSTAMacAddr

  This AP trap indicates that a station has disassociated itself from the AP. The trap contains the MAC address of the associated station.

- brzAPagingTRAP TRAP-TYPE
  ENTERPRISE breezecom
  VARIABLES}
  brzTrapSTAMacAddr

  This AP trap indicates that the station association was aged out and removed from that AP. The trap contains the MAC address of the aging station.

- brzAProamedoutTRAP TRAP-TYPE
  ENTERPRISE breezecom
  VARIABLES}
  brzTrapSTAMacAddr

  This AP trap indicates that a given station has roamed out of the AP's

range. The trap contains the MAC address of the station which has roamed out.

```
brzSTAassociatedTRAP TRAP-TYPE
        ENTERPRISE breezecom
    VARIABLES}
        brzLastAPMacAddr, (old AP MAC address)
                brzTrapAPMac, (new AP MAC address)
                brzTrapLastRssiQuality, (Average RSSI with old AP)
                brzTrapRssiQuality(Average RSSI with new AP)
```

This station trap indicates that the station has become associated with or has roamed to a new AP. The trap contains the MAC address and the average RSSI level of the new AP. If the station has been roaming, the MAC address of the old AP and the RSSI level prior to roaming is also provided (for an association, the second address appears as all zeros).

- brzGeneralTRAP TRAP-TYPE
        ENTERPRISE breezecom
    VARIABLES}
                brzTrapIndex
      brzTrapText

  This is an AP and STA general purpose trap to be used for future trap implementation.

```
TRAP Sending  is Enabled

0 - Disable Trap Sending
1 - Enable Trap Sending

  Enter exactly 1 decimal digits

  (allowed range: from 0 to 1)

  >
```

Figure 4.9: The SNMP Traps Screen

⇒ ***To activate and/or deactivate SNMP trap sending:***

At the cursor, type `0` to disable or type `1` to enable trap sending.

4.1.1.2.5. Display Current Values

```
Values in non volatile ram:
===========================
IP Address -
  Hex format.      Ip address: 0xC7CB8DD7,       Mask: 0xFFFFFF00
  Decimal format. Ip address: 199.203.141.215, Mask: 255.255.255.000
Default gateway -
  Hex format.      Ip address: 0x00000000,
  Decimal format. Ip address: 000.000.000.000, Mask: 000.000.000.000

TRAP Sending is Enabled

  Hit any key to return >
```

Figure 4.10: The Display Current Values Status Screen

This read-only screen displays information concerning the current status of all IP-related items (IP address, subnet mask, default gateway addresses and SNMP trap sending).

4.1.1.3. Wireless LAN (WLAN) Parameters

```
BreezeNet PRO Series (SA-10)

Official Version - $Revision:   3.204  $
$Date:   17 Feb 1997 17:30:46  $
Wireless LAN Parameters menu
============================
1 - Hopping Sequence (Only for AP)
2 - ESS ID
3 - Max. Data Rate
4 - Transmit Diversity
5 - Mobility
6 - Load Sharing
7 - Display Current Values
Select option > 1
```

Figure 4.11: The WLAN Parameters Menu

The WLAN Parameters Menu contains the following options:

- Hopping Sequence
- ESS ID

- Maximum Data Rate
- Transmit Diversity
- Mobility
- Load Sharing
- Display Current Values

4.1.1.3.1. Hopping Sequence

```
HOPPING SEQUENCE          = 1

 (allowed range: 1 - 22)

 Enter up to 3 decimal digits

 >
```

Figure 4.12: The Hopping Sequence Screen

A hopping sequence is a set of pre-defined channels (frequencies) that are used in a specific, pseudo-random order as defined in the sequence. The unit "hops" from frequency to frequency according to the 802.11 standard. When more than one AP are co-located in the same area (even if they are not part of the same network) it is recommended to assign a different hopping sequence to each co-located AP.

This parameter is set only in AP-10 PRO Access Point. It is not accessible from any other ***BreezeNET PRO*** unit. All other stations learn it from the Access Point during the association process. Different co-located WLAN segments should use different hopping sequences.

⇒ ***To modify the hopping sequence:***

At the cursor, type in the required hopping sequence (between 1 and 22) according to the instructions on the dialog screen.

4.1.1.3.2. ESS ID

```
ESS ID: ESSID1



  Enter up to 32 printable ascii chars

  >
```

Figure 4.13: The ESS ID Screen

The ESS ID is an ASCII string used to identify a WLAN. The ESS ID is a WLAN segment. This ID prevents the unintentional merging of two co-located WLANs. It is the System Administrator's responsibility to verify that the ESS ID is set to the same value in all stations and Access Points in the extended WLAN.

Note: *The ESS ID must be all capital letters. No spaces are allowed.*

⇒ ***To configure the ESS ID:***

1. At the cursor, type the required ESS ID according to the instructions on the dialog screen (up to 32 printable characters). The default is "ESSID1".

2. Reboot the unit for the changes to take effect.

4.1.1.3.3. Maximum Data Rate

```
Max. Data Rate           = 3 Mbps



  Enter exactly 1 decimal digits

  (allowed range: from 1 to 3)

  >
```

Figure 4.14: The Maximum Data Rate Screen

BreezeNET PRO products operate at 1 Mbps, 2 Mbps or 3 Mbps. The unit dynamically selects the highest possible rate for transmission. Under certain conditions (compatibility reasons or for range/speed trade-off) you may decide not to use the higher rates.

⇒ ***To configure the maximum data rate:***

1. At the cursor, type the required data rate using the digit only (`1`, `2`, or `3`).The default is `3 - 3 Mbps`.

2. Reboot the unit for the changes to take effect.

4.1.1.3.4. Transmit Diversity

```
Transmit Diversity = Use Two Antennas


0 - Use Two Antennas

1 - Use Antenna No. 1

2 - Use Antenna No. 2


  Enter exactly 1 decimal digits

  (allowed range: from 0 to 2)

   >
```

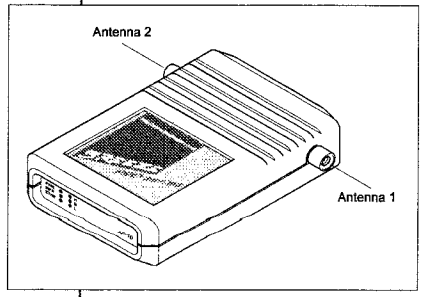


Figure 4.15: The Transmit Diversity Screen

When a ***BreezeNET PRO*** unit receives, it dynamically selects the antenna where reception is optimal. When the unit transmits, it automatically transmits from the antenna last used for reception. However, in models with external antennas, sometimes only a single antenna is used. If this is the case, Transmit Diversity must be configured to transmit only from that single antenna.

⇒ ***To configure Transmit Diversity***

1. At the cursor, type in the number of the option required (`0 - use`

two antennas, 1 - use antenna no.1, or 2 - use antenna no.2) The default is Use Two Antennas.

2. Reboot the unit for all changes to take effect.

4.1.1.3.5. Mobility

```
*
Mobility = Stationary

0 - Stationary
1 - Portable
2 - Mobile

  Enter exactly 1 decimal digits
  (allowed range: from 0 to 2)
  >
```

Figure 4.16: The Mobility Screen

Wireless stations can be used in one of three mobility modes:

Mobile

The station moves while operating in the network.

Portable

The station is sometimes moved, but usually operates in a stationary environment.

Stationary

The station does not move.

BreezeNET PRO stations optimize their roaming algorithms according to the mobility mode parameter. For example, a stationary station is more tolerant of bad propagation conditions. It assumes that this is a temporary situation and is not caused by the station changing position. Initiating a roaming procedure in such a case would be counter-productive.

A mobile station continuously checks for a better AP and tries to roam to a better AP even when the currently received signal is clear and strong.

⇒ ***To configure Mobility:***

1. At the cursor, type in the number which appears next to the required option (`0 -Stationary`, `1 - Portable`, or 2 - Mobile). The default is `0 - Stationary`.

2. Reboot the unit for the changes to take effect.

4.1.1.3.6. Load Sharing

```
Load Sharing = Enabled

0 - Disabled
1 - Enabled

  Enter exactly 1 decimal digits

  (allowed range: from 0 to 1)

>
```

Figure 4.17: The Load Sharing Screen

When installing a Wireless LAN network in a high-traffic environment, you can increase the aggregate throughput by installing a number of APs to create multiple co-located cells. When load sharing is enabled, the wireless stations use load balancing to equally divide the traffic load between the APs.

⇒ ***To configure Load Sharing:***

1. At the prompt, type (`1`) to enable load sharing or type (`0`) to disable load sharing. The default is `(0) - disable`.

2. Reboot the unit for the changes to take effect.

4.1.1.3.7. Display Current Values

```
        *

Hopping Standard:          US FCC and Europe ETSI

Hopping Sequence:          1

ESS ID: ESSID1             ESSID1

Max. Data Rate:            3 Mbps

Transmit Diversity:        Use Two Antennas

Mobility:                  Stationary

Load Sharing:              Disabled

Power Level:               High

Hit any key to return >
```

Figure 4.18: The WLAN Current Values Status Screen

When Display Current Values is selected in the WLAN menu, a read-only status screen appears displaying all the current WLAN parameters. Hit any key to return to the WLAN Parameters Menu.

4.1.1.4. Bridging Menu

```
BreezeNet PRO Series (SA-10)

Official Version - $Revision:   3.204  $
$Date:   17 Feb 1997 17:30:46  $
Bridging menu
=============
1 - LAN to WLAN Bridging Mode (AP only)
2 - IP Filtering
3 - Appletalk Tunneling
Select option > 1
```

Figure 4.19: The Bridging Menu

There are three bridging options:

LAN to WLAN Bridging mode may be configured for AP units only. This option is irrelevant to other BreezeNET PRO Series units.

IP Filtering is selected in networks where it is known that only IP traffic should pass through the WLAN. Enable IP Filtering to filter out any other protocol.

When Appletalk tunneling is enabled, the AP can communicate with the Appletalk protocol. However this is relevant only when the bridging mode is configured to option 1, Forward Unknown.

4.1.1.4.1. Bridge Mode

```
Bridge Mode: Reject Unknown


0 - Reject Unknown
1 - Forward Unknown

  Enter exactly 1 decimal digits

  (allowed range: from 0 to 1)

  >
```

Figure 4.20: The Bridge Mode Screen

This dialog screen allows the user to select the required bridge mode for the AP. There are two options:

- Reject Unknown

  The Reject Unknown option allows transmission of packets only to stations that the AP knows to exist in the Wireless LAN behind the Wireless Bridge.

- Forward Unknown

  The Forward Unknown option allows transmission of all packets except those sent to stations that the AP recognizes as being on its wired Ethernet

side.

⇒ ***To set the Bridge Mode:***

At the cursor, type `0` to select `Reject Unknown` or type `1` to select `Forward Unknown`. (The default is `Reject Unknown`.)

4.1.1.4.2. IP Filter

```
IP Filter Disabled


0 - Disabled
1 - Forward Only IP

  Enter exactly 1 decimal digits

  (allowed range: from 0 to 1)

  >
```

Figure 4.21: The IP Filter Screen

This dialog screen allows you to set the IP filter for bridging purposes. There are two options:

- Disabled
- Forward Only IP

⇒ ***To set the IP filter:***

At the cursor, type in the number next to the option (`0 - Disabled`, `1 - Forward Only IP`. The Default is `0 - Disabled`.

4.1.1.4.3. Appletalk Tunneling

```
AppleTalk Tunneling Enabled



0 - Disable Tunneling
1 - Enable Tunneling


  Enter exactly 1 decimal digits

  (allowed range: from 0 to 1)

  >
```

Figure 4.22: The Appletalk Tunneling Screen

Enable Appletalk tunneling if the network contains a mix of Ethertalk1 (ET1) and Ethertalk2 (ET2) stations. This ensures smooth communications.

⇒ ***To set Appletalk Tunneling:***

At the cursor, type the number that appears next to the required options (`0 - Disable Tunneling` or `1 - Enable Tunneling`). The default is `1 - Enable Tunneling`.

4.1.1.5. Station Control Menu

```
BreezeNet PRO Series (SA-10)
Official Version - $Revision:   3.204  $
$Date:   17 Feb 1997 17:30:46  $
Station Control menu
====================
1 - Reset Unit
2 - Set Factory Defaults
Select option > 1
```

Figure 4.23: The Station Control Menu

This menu contains two options:

- System Reset
- Set Factory Defaults

4.1.1.5.1. System Reset

```
0 - Cancel request
1 - Reset system now

  Enter exactly 1 decimal digits

  (allowed range: from 0 to 1)

  > 1

System is about to be reset now...
```

Figure 4.24: The System Reset Screen

This option resets the BreezeNET PRO unit and applies any changes made to the system parameters. At the cursor, type 1 to reset the system, or type 0 to cancel the request.

4.1.1.5.2. Set Factory Defaults

```
*
0 - Cancel request
1 - Load default values into NV RAM

  Enter exactly 1 hex digits
  (allowed range: from 0 to 1)
  >
```

Figure 4.25: The Set Factory Defaults Screen

When this option is implemented, all system parameters revert back to the original factory default settings.

⇒ ***To set factory defaults:***

1. At the cursor, type 1 to load default values or type 0 to cancel the request.

2. Reboot the unit for the change to take effect.

4.1.2. Advanced Settings Menu

```
BreezeNET PRO Series (SA-10)
Beta Version - $Revision:  3.209  $
$Date:   23 Feb 1997 17:34:16  $
Advanced Settings menu
======================
1 - Compatibility
2 - Roaming
3 - Performance
4 - Radio
5 - Rate
6 - AP Redundancy Support
7 - Maintenance
Select option >
```

Figure 4.26: The Advanced Settings Menu

Modification of the parameters that can be accessed from this menu is limited to authorized ***BreezeCOM*** personnel only. The only menu that is of interest to the user is the Rate menu which is used in conjunction with Display Counters in the System Counters menu (see section 4.1.3.1.1., "Display Counters") when performing the Site Survey procedure (see section 3.9., "Site Survey").

4.1.3. Site Survey Menu

```
*
BreezeNet PRO Series (SA-10)
Official Version - $Revision:   3.2  $
$Date:   19 Feb 1997 16:32:32  $
Site Survey menu
================
1 - System Counters
2 - Survey Software
Select option >
```

Figure 4.27: The Site Survey Menu

The Site Survey Menu gives access to the following:

- System Counters Menu

- Survey Software menu

4.1.3.1. System Counters Menu

```
BreezeNet PRO Series (SA-10)
Official Version - $Revision:   3.204  $
$Date:   17 Feb 1997 17:30:46  $
System Counters menu
========================
1 - Display Counters
2 - Reset Counters
Select option > 1
```

Figure 4.28: The System Counters Menu

The System Counters contain statistics concerning frames received and transmitted from the Ethernet and over the Wireless LAN.

The System Counters menu gives access to the following options:

- Display Counters
- Reset Counters

4.1.3.1.1. Display Counters

```
Ethernet Counters
=================
 Total received frames  : 0
 Received bad  frames   : 0
 Received good frames   : 0
 Forwarded to bridge    : 0
 Missed Frames: 0
 Transmitted to Ethernet: 2

WLAN Counters
=============
 Total transmitted frames           : 1020350
 Total transmitted frames (bridge)  : 0
 Frames Dropped (too many retries)  : 0
 Total transmitted fragments        : 1020351
 Total retransmitted fragments      : 0
 Total tx errors                    : 1735
 Internally Discarded               : 0
 Power Saving Aged                  : 0
 Power Saving Free Entries          : 0

 Total received frames          : 733
 Total received data frames     : 2
 Total received fragments       : 733
 Bad fragments received         : 0
 Duplicated fragments received  : 0

 Prob Request sent : 1020355; lost : 0; per handoff :
340118
  Hit any key to return >
```

Figure 4.29: The Display Counters Status Screen

The Display Counters read-only status screen presents two types of counters, Ethernet and WLAN counters. This screen is used when performing the Site Survey procedure (see section 3.9., "Site Survey").

Ethernet Counters

Total Received Frames

Indicates how many frames have been received from the Ethernet port.

Received Bad Frames

Indicates how many errored frames have been received from the Ethernet port.

Received Good Frames

Indicates how many good frames have been received.

Forwarded to Bridge

Indicates how many of the "good" frames received were forwarded to the bridge engine. This should be the same as the number of good frames received, unless the bridge is overloaded.

Missed Frames

The total number of missed frames.

Transmitted to Ethernet

Indicates how many frames have been transmitted to Ethernet. These are mostly LAN frames, however, some frames are generated internally by the station.

WLAN Counters

Total Transmitted Frames

Indicates how many frames were transmitted to the WLAN.

Total Transmitted Frames (Bridge)

In most ***BreezeNET PRO*** units, the number of total transmitted frames and total transmitted frames (bridge) are identical. In the case of the AP, due to the inclusion of beacon frames, this number will be higher than that for Total transmitted frames.

Frames Dropped

Frames dropped after too many unsuccessful re-transmission attempts.

Total Transmitted Fragments

Frames that are bigger that the maximum packet size are fragmented. They are then transmitted as several fragments. This counter shows how many fragments were transmitted.

Total Retransmitted Fragments

This counter shows how many fragments were retransmitted due to various causes.

Total Tx Errors

This indicates how many transmit errors have occurred. Currently this counter also includes normal situations where a fragment has not been transmitted because the dwell time has elapsed.

Internally Discarded

Ethernet - WLAN buffer overflow.

Power Saving Aged

Frames discarded from the overflow buffer.

Total Received Frames

This shows how many frames (including beacons transmitted from the AP) have been received by the station.

Total Received Data Frames

The number of frames not including beacons received by the station.

Total Received Fragments

The number of fragments received by the station.

Bad Fragments Received

The number of fragments with a CRC error condition received.

Duplicated Fragments Received

When the unit receives frames, it sends an acknowledgment to the transmitter unit. If the transmitter unit does not receive the acknowledgment, it re-transmits the frame. The receiving unit identifies these re-transmitted frames as duplicated.

4.1.3.1.2. Reset Counters

```
*
0 - Cancel request
1 - Reset counters now

  Enter exactly 1 decimal digits
  (allowed range: from 0 to 1)
  >
```

Figure 4.30: The Reset Counters Screen

⇒ ***To reset system counters to 0:***

At the cursor, type 1 to reset counters or type 0 to cancel the request. There is no need to reset the unit after clearing the counters.

4.1.3.2. Survey Software menu

```
BreezeNET PRO Series (SA-10)
Version-$Revision:  3.207 $
$Date: 19Feb 1997 16:32:32 $
Survey Software menu
======================
1 - Operation mode(Idle/RX/TX)
2 - Data Type
3 - Data Rate
4 - Antenna
5 - Power Level
6 - Frequency Hopping
7 - Number of Packets to Tx
8 - Time Between Packets
9 - Packet Length
D - Display actual configuration
L - Load Default Configuration
T - Toggle to display received parameters
S - Start Statistics
Q - Stop Statistics
Select option >
```

Figure 4.31: The Survey Software Menu

When performing pre-installation Site Survey for optimizing external antenna alignment, use this menu to set all required survey parameters and to initiate and stop display of statistics.

⇒ ***To access Survey software menu and screens:***

1. In the main menu, type (3) at the cursor. The Site Survey menu appears.

2. In the Site Survey menu, type (2) at the cursor. The Survey Software menu appears.

3. Type the number or letter to the left of the required option. The

corresponding screen is displayed. Follow the instructions that appear on the screen.

⇒ ***To perform pre-installation Site Survey using Survey Software:***

1. Roughly align the antennas on either side of the link before starting the Site Survey procedure.

2. In the Operation mode screen (see section 4.1.3.2.1.), set the units on either side of the link to either receive (option 1) or transmit (option 2) packets (one unit should be set to transmit and the other to receive). Option 0 (Idle mode) is not active at present.

3. Make no changes in the following screens:

   - Transmit Data
   - Data Rate
   - Antenna
   - Power Level
   - Frequency Hopping menu
   - Number of Packets to Transmit
   - Time Between Packets
   - Packet Length

   These screens reflect the defaults already set in the unit and need not be changed in order to carry out the survey.

4. Start the survey by selecting option (S) in the Survey Software menu in both units. On the transmit side, a screen appears displaying a table showing the number of packets and the frequency at which each packet was transmitted. This list is updated continuously. Select option (Q) to stop updating the list. On the receive side of the link, the screen displays a table showing the number of packets received, the frequency at which each packet was transmitted, The Received Signal Strength Indicator (RSSI) for each

antenna and the Bit Error Rate (BER). Use these tables to check received signal strength.

5. Re-align the antenna on the receive side until maximum received signal strength is attained. As you align the antenna, you will see that the RSSI (received signal strength indicator) continually increases until it reaches a certain level after which the RSSI begins to decrease. This is the maximum attainable RSSI level indicating optimum receive antenna alignment.

6. Now switch the functions of either side of the link (set transmit unit to receive and receive unit to transmit) and repeat the procedure to check the link from the opposite direction.

4.1.3.2.1. Operation Mode

```
MODE OF OPERATION                    Rx only

0 - Idle mode

1 - Receive only

2 - Transmit packets

  Enter exactly 1 decimal digits

  (allowed range: from 0 to 1)

  >
```

Figure 4.32:The Mode of Operation Screen

4.1.3.2.2. Transmit Data

```
TX DATA

0 - Null Packets (for pcmcia only)

1 - Pseudo-random Data

  Enter exactly 1 decimal digits

  (allowed range: from 0 to 1)

  >
```

Figure 4.33: The Transmit Data Screen

Data is transmitted in the form of pseudo-random data. This is the default. Option 1 (Null Packets) is for use with PCMCIA cards and is a future option. Do not change this setting.

4.1.3.2.3. Data Rate

```
DATA RATE                                1

1 - 1 Mb/s
2 - 2 Mb/s
3 - 3 Mb/s

  Enter exactly 1 decimal digits

  (allowed range: from 1 to 3)

  >
```

Figure 4.34: The Data Rate Screen

This screen indicates the rate at which the unit is transmitting. Do not make any changes to this screen.

4.1.3.2.4. Antenna

```
ANTENNA                                    Automatic Selection


0 - Automatic Selection

1 - Antenna 1 active
2 - Antenna 2 active

  Enter exactly 1 decimal digits

  (allowed range: from 0 to 2)

  >
```

Figure 4.35: The Antenna Screen

This screen reflects the state of the antennas as configured in Transmit Diversity (see section 4.1.1.3.4.).

4.1.3.2.5. Power Level

```
POWER LEVEL                                HIGH


0 - Low Level

1 - High Level

  Enter exactly 1 decimal digits

  (allowed range: from 0 to 1)

  >
```

Figure 4.36: The Power Level Screen

This screen displays the level of power at which the unit is operating. There are two possibilities, Low or High. In this case, the unit is operating at a high power level.

4.1.3.2.6. Frequency Hopping menu

```
BreezeNET PRO Series  (SA-10)

Version - $Revision:  3.207  $
$Date:  17 Feb 1997 17:30:46  $
Hopping menu
============
1 - Type of Frequency Hopping
2 - Hopping Channel (for automatic hopping only)
3 - Frequency Channel (for manual frequency selection
only)
Select option >
```

Figure 4.37: The Frequency Hopping Menu

This menu gives access to the following screens:

- Type of Frequency Hopping
- Hopping Channel
- Frequency Channel

Frequency Hopping is configured in the Access Points only. The values displayed in the other units associated with a particular Access Point merely reflect that configuration.

4.1.3.2.6.1. Type of Frequency Hopping

```
AUTOMATIC HOPPING


0 - Automatic Hopping (default value)

1 - Manual Frequency Selection

2 - Read From Table (not implemented yet)


  Enter exactly 1 decimal digits

  (allowed range:  from 0 to 2)
```

Figure 4.38: The Type of Frequency Hopping Screen

This screen reflects the type of frequency hopping set in the Access Point.

4.1.3.2.6.2. Hopping Channel

```
HOPPING CHANNEL                    17

  Enter up to 3 decimal digits

  (allowed range: from 0 to 100)
```

Figure 4.39: The Hopping Channel Screen

This screen indicates the hopping channel used in the Access Point when automatic hopping has been selected.

4.1.3.2.6.3. Frequency Channel

```
FREQUENCY CHANNEL                  0

  Enter up to 3 decimal digits

  (allowed range:  from 0 to 100

  >
```

Figure 4.40: The Frequency Channel Screen

This screen indicates the frequency at which the hopping channel is operating when manual frequency selection has been implemented in the Access Point.

4.1.3.2.7. Number of Packets to Tx

```
No. OF TX PACKETS                    infinite

0 - infinite

  Enter up to 5 decimal digits

  (allowed range:  from 0 to 64000)

  >
```

Figure 4.41: The Number of Tx Packets Screen

This screen indicates the number of data packets transmitted.

4.1.3.2.8. Time Between Packets

```
TIME BETWEEN PACKETS                 3

Values will be interpreted as seconds/10
```

Figure 4.42: The Time Between Packets Screen

This screen indicates the time between data packets measured in 100 millisecond units.

4.1.3.2.9. Tx Packet Length

```
Tx PACKET LENGTH                     400

(Minimum value is 24 bytes)

  Enter up to 3 decimal digits

  (allowed range:  from 0 to 500)

  >
```

Figure 4.43: The Tx Packet Length Screen

This screen indicates the length of each data packet measured in bytes.

4.1.3.2.D. Display Actual Configuration

```
STATION TYPE                        Station

MODE OF OPERATION                   Rx only

DATA RATE                           1

ANTENNA                             Automatic Selection

POWER LEVEL                         HIGH

TX DATA                             Pseudo-random Data

No. of TX PACKETS                   infinite
TIME BETWEEN PACKETS                3

Tx PACKET LENGTH                    400

HOPPING CHANNEL                     17

FREQUENCY CHANNEL                   0

READ CHANNEL TABLE

Default Parameters Loaded


  Hit any key to return >
```

Figure 4.44: The Display Actual Configuration Status Screen

This screen displays all the default parameters to be used in the Site Survey procedure.

4.1.3.2.L. Load Default Configuration

```
Default Parameters Loaded


  Hit any key to return >
```

Figure 4.45: The Load Default Configuration Screen

If any changes were made for any reason to any of the previous parameters, select this option to cancel these changes and return to the original default parameters.

4.1.3.2.S. Start Statistics

```
Enter any digit to start test


  Enter exactly 1 decimal digits
  >
```

Figure 4.46: The Start Statistics Screen

Enter any digit to start Site Survey.

4.1.3.2.Q. Stop Statistics

```
  Hit any key to return >
```

Figure 4.47: The Stop Statistics Screen

Hit any key to stop update of Site survey statistics.

4.1.4. Access Control Menu

Access Control functions enable the System Administrator to limit access to Local Terminal Maintenance setup and configuration menus.

⇒ ***To access the Access Control Menu:***

1. In the main menu, type (4) at the cursor. The Access Control menu appears.

```
BreezeNet PRO Series (SA-10)
Official Version - $Revision:   3.2  $
$Date:   17 Feb 1997 17:30:46  $
Access Control menu
===================
1 - Change Access Rights
2 - Change Installer Password
S - Show Current Access Right
Select option > 1
```

Figure 4.48: The Access Control Menu

The Access Control menu gives the System Administrator access to the following options:

- (1) Change Access Rights
- (2) Change Installer Password
- (S) Show Current Access Right

2. At the cursor, type the number or letter next to the required option to access the relevant screen.

4.1.4.1. Change Access Rights Menu

```
BreezeNet PRO Series (SA-10)
Official Version - $Revision:   3.2  $
$Date:   17 Feb 1997 17:30:46  $
Change Access Rights menu
=========================
0 - User
1 - Installer
2 - Technician
Select option > 2
```

Figure 4.49: The Change Access Rights Menu

Change Access Rights determines the level of access rights to the ***BreezeNET PRO*** unit's setup and configuration menus. There are three options: User, Installer and Technician. When the unit is first installed, the default setting is option (1), Installer and the default password is "user".

- User

  The Local Terminal Management menus are read-only for a user who does not possess the correct password.

- Installer

  The installer has access to configure certain parameters in the system. Access is password-protected. After configuration, the installer changes access rights to option (0), User. The installer can also change the password (see section 4.1.4.2., "Change Installer Password").

- Technician

  When the Technician option is selected, only an authorized BreezeCOM technician possessing the correct password can configure a much wider range of parameters than the installer.

  To view current access rights status, see section 4.1.4.3., "Show Current Access Right", below.

⇒ ***To change access rights:***

At the cursor, type in the number next to the option you require (0,1,or 2).

4.1.4.2. Change Installer Password

```
Maximum Password length: 8 characters

  Enter up to 8 printable ascii chars

  >
```

Figure 4.50: The Change Installer Password Screen

In this dialog screen, the installer can change the password to prevent unauthorized persons from making any changes in system configuration and setup. The password is limited to eight printable ASCII characters.

⇒ ***To change the installer password:***

At the cursor, type in the new password according to the directions on

screen.

4.1.4.3. Show Current Access Right

```
CURRENT RIGHTS: INSTALLER
```

Figure 4.51: The Show Current Access Right Status Screen

This read-only screen presents the current access right configuration. It cannot be changed. If you want to change access rights, use the Change Access Rights menu.

4.2. SNMP Management

All products in the ***BreezeNET PRO Series*** as well as the Extended Range Access Point (AP-10 DE) and Wireless Bridge (WB-10 DE) contain an embedded SNMP agent. The setup and configuration functions described in the previous section as well as other functions can be accessed from the Management Information Base (MIB) using the SNMP application.

BreezeNET PRO Series agents support the following MIBs:

- MIB-II (RFC1213)
- BRIDGE-MIB (RFC1286)
- BreezeCOM Private MIB Version 1.0

The complete list of the BreezeCOM Private MIB can be found in Appendix E.

5. SYSTEM TROUBLESHOOTING

5.1. Troubleshooting Guide

The following troubleshooting guide provides answers to some of the more common problems which may occur when installing and using ***BreezeNET PRO Series*** products. If problems not mentioned in this guide should arise, please contact our Technical Support Department.

Problem and Indication	Possible Cause	Corrective Action
No Power to Unit. PWR LED is off.	1. Power cord is not properly connected. 2. Power supply is defective.	1. Verify power cord is properly connected to the BreezeNET unit and to the power outlet. 2. If this is not the cause, replace the power supply.
Failure to establish wireless link. WLNK LED is off and unit resets every few minutes.	1. Power supply to units may be faulty 2. The units may not have the same ESSID as the AP-10.	1. Verify power to units (AP and SA/WB). 2. Verify that all units in the network have the same ESSID as the AP (ESSID must be identical in all units in the network): 3. Verify wireless link: • Set AP and unit (SA or WB) side by side. • Power on each unit and see if a wireless link is established (even "D" models without their external antennas should establish a link if placed side by side with the AP). • If the units fail to associate, reset units to factory default values (see section 4.1.1.5.2.) and reset unit (see section 4.1.1.5.1.). The units should now establish a wireless link.

Problem and Indication	Possible Cause	Corrective Action
Failure to establish wireless link ("D" models/external antennas)	1. Power supply to units may be faulty. 2. Cables may be improperly connected 3. There may be some problem with antenna installation.	1. Verify power to units. 2. Verify that all cables are connected securely. 3. Refer to previous section and verify wireless link between the units. 4. Verify that the antenna(s) are properly installed: • Check antenna alignment (see section see section 3.8.2., "Antenna Alignment"). • Verify that antenna polarization is the same at both ends (see section see section 3.8.4., "Antenna Polarization"). • Verify that the range matches specifications (see section 3.6.). • Verify line-of-sight/antenna alignment/antenna height (see section 3.8.).
Wireless link established, but there is no Ethernet activity (AP and WB units).	1. Ethernet hub port or UTP cable is faulty. 2. Ethernet port in unit is faulty.	1. Check that the LINK LED is on and solid at the hub port. If this is not the case, the port is inactive. Try another port on the hub or another UTP cable 2. Verify that Ethernet port in unit is working. Ping unit to verify Ethernet connection. 3. Verify that you are using a crossover UTP cable (pins 1 & 3, 2 & 6) if connected directly to workstation, or a straight-through cable if connected to a hub. 4. Check ETHR LED indicator in unit and Ethernet counters in Monitor to verify Ethernet activity (see section 4.1.3.1.).

Problem and Indication	Possible Cause	Corrective Action
Wireless link established, but there is no Ethernet activity (SA-10 and SA-40 units).	1. Ethernet port on Network Interface card is faulty. 2. Ethernet port of unit is faulty. 3. UTP cable is faulty.	1. Verify that the LINK LED is lit and solid at the NIC port. If this is not the case, the port is inactive. Try using another UTP cable or another workstation. 2. Ping the unit to check the Ethernet port. If you cannot ping the unit, this may indicate failure of cable, Ethernet port of unit or Ethernet port of workstation's NIC. Change UTP cable and retry. If you still cannot ping the unit, exchange units and try to ping the new unit using the same NIC and cable.
No network detected at Station Adapter (SA-10, SA-40) workstation.	1. Workstation networking is improperly configured. 2. UTP cable connection is faulty. 3. Failure to pass Ethernet packets.	1. Reset both Access Point and Station Adapter. • Re-establish network connection. • Verify proper workstation network configuration. 2. Try to ping the remote network. Failure to detect the network may indicate a failure to pass Ethernet packets. 3. Verify UTP cable connection. Solid LINK LED in workstation NIC indicates proper Ethernet connection. 4. Check monitor messages for errors or other indications of problems. 5. Check station counters to verify increase in Ethernet counters which indicates Ethernet activity (see section 4.1.3.1.).

Problem and Indication	Possible Cause	Corrective Action
High quality signal but throughput is poor.	1. Too much interference or multi-path propagation. 2. Ethernet port of the unit may be faulty.	1. Move the unit or the antennas out of the range of interference. • Check counters to see if more than 10% of total transmitted frames are retransmitted fragments (see section 4.1.3.1.). • Check if more than 10% of total received data frames are bad fragments (see section 4.1.3.1.). 2. Verify Ethernet port activity by checking Ethernet counters (see section 4.1.3.1.).
Link signal quality low or not as good as expected (indoor installation).	1. Possible multipath or structural interference.	1. Reposition the unit outside range of possible interference. • Check for heavy metal structures (e.g. elevators. racks, file cabinets) near unit. • Check counters for excessive retransmissions or received bad fragments. • Site may require higher gain antennas. • site may require a multicell structure (multiple AP units) due to multipath/structural interference.
Link signal quality low or not as good as expected (outdoor installation).	There may be a problem with certain aspects of outdoor installation considerations (see section 3.8.).	Refer to section 3.8.: • Verify that there is a clear line-of-site. • Verify antenna height. • Verify antenna polarization. • Verify antenna alignment. • Check length of cable between antenna and unit (an overly long extension cable may adversely affect performance).
Unit associates with the wrong Access Point.	In a multicell structure with overlapping cells, the units may not associate with the closest Access Point.	For a unit to associate with a specific Access Point, assign a unique ESSID to the Access Point and to all the units you want to include in that wireless network.

Problem and Indication	Possible Cause	Corrective Action
Reduced performance in a multi-AP configuration.	The APs in the same coverage area have not been assigned unique hopping sequences.	Assign a unique hopping sequence to each AP in the coverage area. Each AP must have a unique hopping sequence regardless of ESSID.

5.2. Checking Counters

Checking counters is also a good way to pinpoint any problems that may occur in the ***BreezeNET*** wireless LAN. Counters can be checked from the monitor. See section 4.1.3.1..

5.2.1. WLAN Counters

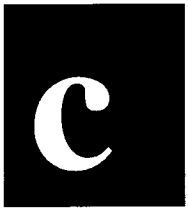
When checking WLAN counters, total retransmitted fragments should be below 10% of total transmitted (bridge) frames. If total retransmitted fragments are above 10%, this indicates errors in data transmission. Too many retransmissions may be an indication of interference between the transmitting and receiving units.

Received bad fragments should be no more than 10% of the total received data frames. If more than 10% of the total received data frames are bad fragments, this may indicate that there is a problem with the wireless link.

Refer to the Troubleshooting guide above for possible corrective action.

5.2.2. Ethernet Counters

When checking the Ethernet counters, received bad frames should be zero (0). If this is not the case, this may indicate a problem with the Ethernet connection. Verify Ethernet port link at hub, workstation, and unit. Assign a unique IP address to the unit and ping.



PRODUCTS

6. TECHNICAL SPECIFICATIONS

The following table provides the technical specifications for all products in the ***BreezeNET PRO Series***.

Technical Specifications	Access Points AP-10xxPRO	Station Adapters SA-10/40xxPRO	Ethernet Bridges WB-10xx PRO	PCMCIA Adapters SA-PC PRO
Wired LAN interface				
Compliant with	Ethernet / IEEE 802.3 CSMA/CD standard			
Physical Interface	10BaseT			PC card type II
Network Operating Systems supported	All			Netware, Win95, and Win NT
Network protocols supported	All			NDIS / ODI
Wireless LAN interface				
Designed to meet	IEEE 802.11 CSMA / CA wireless LAN standard drafts			
Physical interface - two antennas	Integrated or external			Integrated
Radio Specifications				
Type	Frequency Hopping Spread Spectrum (FHSS)			
Frequency range	2.4 GHz - 2.4835 GHz (ISM band) (different ranges available for countries using other bands)			
Dwell time	32, 64, 128 ms			
Transmitted power: integrated antennas -	5 mW or 100 mW (20dBm) EIRP			100 mW EIRP
external antennas-	- 50 mW (17 dBm) at the connector - up to 36 dBm EIRP for 24dBi antenna			--
Sensitivity - @ 1 Mbps - @ 2 Mbps - @ 3 Mbps	- 81 dBm - 75 dBm - 67 dBm			- 80 dBm - 75 dBm
Modulation	Multilevel GFSK			
Demodulation	DSP-based with adaptive equalization			
Antenna Diversity	Two antennas, selected for use on a per-packet basis			

Technical Specifications	**Access Points** AP-10xxPRO	**Station Adapters** SA-10/40xxPRO	**Ethernet Bridges** WB-10xx PRO	**PCMCIA Adapters** SA-PC PRO
Approvals of Compliance	FCC part 15 ETS 300-328 UL, UL/C, TUV/GS, CE			
Configuration and Management				
Configuration and Setup	Via local monitor port (serial RS-232)			Via Notebook PC
SNMP management - SNMP agents	MIB II, Bridge MIB, WLAN MIB, and proprietary MIB			--
- Access via	Wired LAN, Wireless LAN			
Site Survey	Via Local Monitor port (serial RS-232)			Via Notebook PC
Front Panel Display LED indicators	- Power on - /wired LAN activity - Wireless LAN synchronization/Radio interference - Wireless LAN signal quality/Load			- Transmit data - Receive data
S/W upgradeable to IEEE 802.11 when ratified	Yes, through TFTP download			
System Considerations				
Range** (Access Point to Adapter)				
- unobstructed				
- integral antennas	3000 ft. (1000m)			
- external antennas (models D and DE)	USA - FCC - up to 8 miles Europe - ETSI - up to 2.5 km Europe - ETSI (extended) - up to 5 km Deregulated - over 30 km For detailed range information, contact BreezeCOM representative			
- Office Environment	500 ft. (150m)			
Maximum no. of APs per wired LAN	unlimited			
Maximum no. of co-located (overlapping) cells (Access Points)	15			
Data Rate - over the air - nominal net - aggregate	1 Mbps, 2 Mbps, 3 Mbps Up to 1.6 Mbps Over 15 Mbps with overlapped cells			1Mbps & 2 Mbps Up to 1.3 Mbps
High Speed roaming support	yes			
Load sharing support	yes (with WIX™)			

Technical Specifications	**Access Points** AP-10xxPRO	**Station Adapters** SA-10/40xxPRO	**Ethernet Bridges** WB-10xx PRO	**PCMCIA Adapters** SA-PC PRO
Dynamic rate selection based on radio medium quality	yes			
Electrical				
External Power Supply	100V - 240V, 7.5W			--
Input Voltage	5Vdc, 1400mA			XMT-5Vdc, 365mA RCV-5Vdc, 270mA
Dimensions	5.1" x 3.4" x 1.2" (13cm x 8.6cm x 3cm)			2.2"x5.4"x0.5" (5.6x13.7x1.3cm) including the antenna element
Weight	1 lb. (0.45 kg.)			2 oz (60 gr.)
Environmental				
Operating Temperature Operating Humidity	32° F - 105° F (0° C - 40° C) 5% - 95% non-condensing			

7. AP-10 PRO ACCESS POINT

7.1. Package List

When you first open the AP-10 PRO, the package contains the following components:

- The ***BreezeNET*** AP-10 PRO Access Point, complete with two omni-directional antennas or RF connectors for use with external antennas ("D" models).
- This ***BreezeNET PRO Series*** System Administrator Guide.
- AP-10 PRO Quick Installation Guide
- 5V DC power supply transformer.
- A monitor connector cable.
  (For connecting the Access Point to a monitor in order to perform Local Terminal Management functions (see section 4.1.).
- Proprietary MIB disk for performing remote unit configuration and monitoring (see section 4.2., "SNMP Management").
- Mounting bracket for wall or ceiling installations.

Open the packaging carefully and make sure that none of the items listed above are missing. Do not discard packaging materials. If, for any reason, the unit is returned, it must be shipped in its original package.

7.2. Technical Specifications

See the table in Section 6, "Technical Specifications" for the technical specifications of all products in the ***BreezeNET PRO Series***.

7.3. Quick Installation

Quick Installation is for experienced installers and network administrators (see Appendix A for the Quick Installation Guide). All others should continue on to the next section, "Installing the AP-10 PRO".

7.4. Installing the AP-10 PRO

Use the following steps to install the ***BreezeNET PRO*** Access Point:

- Choose the best location to place the Access Point.
- Connect the RF cable and antennas ("D" models only).
- Connect to the power supply.
- Connect to the Ethernet backbone.
- Check functionality using the LED indicators.

Step 1
Position the Access Point

BreezeNET PRO wireless LAN products are robust, trouble-free units, designed to operate efficiently under a wide range of conditions. The following guidelines are provided to help you position the Access Points to ensure optimum coverage and operation of the ***BreezeNET PRO*** LAN.

Height

Install the Access Point at least 1.5m above the floor, clear of any high office partitions or tall pieces of furniture in the coverage area. The Access Point can be placed on a high shelf, or can be attached to the ceiling or a wall using a mounting bracket.

Antennas

Make sure the antennas are extended upward vertically in relation to the floor, or, for AP-10D models, connect the external antennas and RF cable.

Central Location

Install the Access Point in a central location in the intended coverage area. Good positions are:

- In the center of a large room.
- In the center of a corridor.
- At the intersection of two corridors.

Many modern buildings have partitions constructed of metal or containing metal components. We recommend that you install the Access Points on the corridor ceilings. The radio waves propagated by the ***BreezeNET PRO*** LAN are reflected along the metal partitions and enter the offices through the doors or glass sections.

Metal Furniture

Position the Access Points clear of metal furniture and away from moving objects such as metal fans or doors.

Heat Sources

Keep the Access Point well away from sources of heat, such as radiators, air-conditioners, etc.

Microwave Ovens

Position the Access Points clear of radiation sources that emit in the 2.4 GHz frequency band, such as microwave ovens.

Step 2
Connect the Access Point to the Power Supply

The unit operates on a power input of 5V DC, (1200mA). This is supplied by the power transformer included with the unit.

- Plug the output jack of the power transformer into the DC input socket on the rear panel of the AP-10 PRO Access Point.
- Connect the supplied power transformer to an external power supply - 110/220VAC.

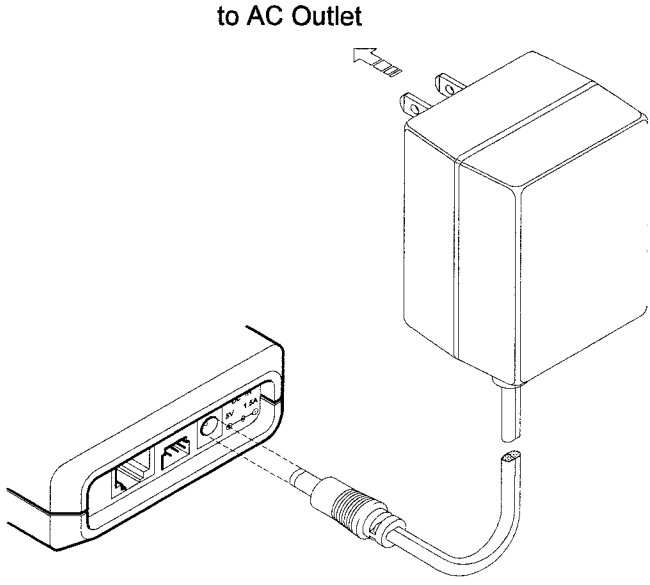


Figure 7.1: Connecting to the Power Supply

Step 3
Connect the Access Point to the Ethernet Backbone

Attach one end of a straight Ethernet 10BaseT cable (not supplied) to the RJ-45 port on the rear panel of the Access Point (marked UTP).

Attach the other end of the connector cable to any available Ethernet outlet. When connecting the AP directly to a network interface card of a server or workstation, use a cross-over 10Base-T cable.

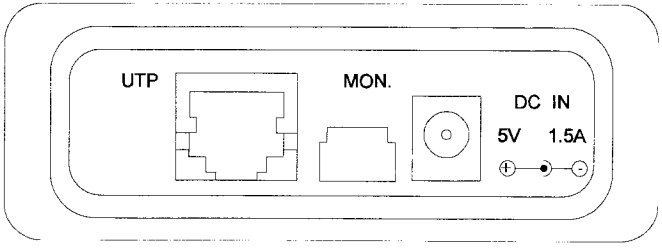


Figure 7.2:AP-10 PRO Access Point Rear Panel

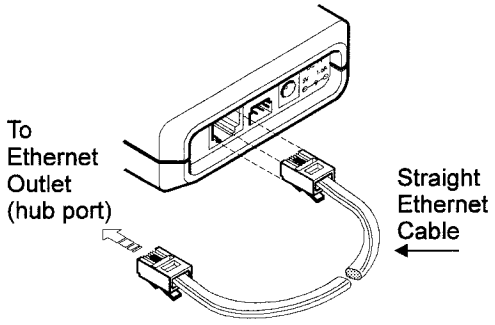


Figure 7.3:Connecting the Access Point to the Ethernet Backbone

Step 4
Check Access Point Functionality using LED indicators

Check the following Access Point functions by using the LEDs on the front panel.

- Power supply
- Radio interference
- Ethernet activity
- WLAN load

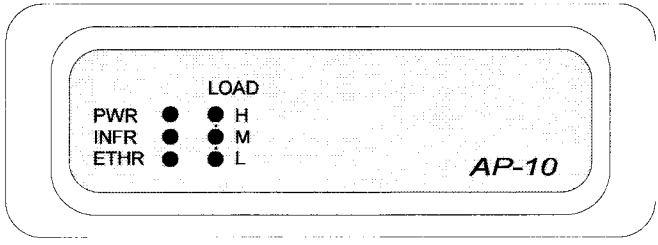


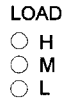
Figure 7.4: AP-10 PRO Front Panel LED indicators

PWR (Power supply; Power on test)
Off -During power off
On -After successful power on

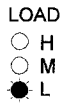
INFR (Radio interference)
Off -No interference
Blinks -Interference present

ETHR (Ethernet activity)
Off -No activity on the Ethernet Port
Blinks -Activity on the Ethernet Port

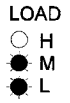
LOAD (L,M,H) (No. of associated stations)



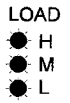
No stations



1-4 stations



5-8 stations



9 or more stations

7.4.1. Verifying the Ethernet Connection

Once the Access Point is connected to an Ethernet outlet, the ETHR LED on the front panel blinks when it senses LAN traffic, thus verifying the Ethernet connection. Verify that the LINK indicator on the attached hub port is ON.

7.5. Management

The ***BreezeNET PRO*** product line has been designed as a plug and play

solution, and operates without any user intervention. However, users wishing to change some of the default parameters can do so to get additional functionality. There are two ways to set the parameters and/or the monitoring status of the station:

- Using a local monitor.
- Using an SNMP Management Information Base.

7.5.1. Local Terminal Management

Procedures for configuring ***BreezeNET AP-10 PRO*** Access Point setup and configuration menus can be found in section 4.1., "Local Terminal Management".

7.5.2. SNMP Management

The ***BreezeNET PRO*** Access Points and Station Adapters contain an embedded SNMP agent. Refer to section 4.2., "SNMP Management".

8. SA-10 PRO STATION ADAPTER

8.1. Package List

When you first open the SA-10 PRO Station Adapter, the package contains the following components:

- The ***BreezeNET SA-10 PRO*** Station Adapter, complete with two omni-directional antennas or RF connectors for use with external antennas ("D" model).
- The SA-10 PRO Quick Installation Guide
- A 5V DC power supply transformer
- A mounting bracket for wall or ceiling installations.

Open the package carefully and make sure that none of the items listed above are missing. Do not discard packaging materials. In case of return, the unit must be shipped in its original package.

8.2. Technical Specifications

See the table in section 6, "Technical Specifications" for the technical specifications of all products in the ***BreezeNET PRO Series***.

8.3. Quick Installation

Quick Installation is for experienced installers and network administrators (see Appendix A for the Quick Start Installation Guide). All others should continue on to the next section, "Installation".

8.4. Installation

This section describes how to install the ***BreezeNET SA-10 PRO*** Station Adapter and provides an explanation of how the Station Adapter automatically establishes connectivity with the wireless LAN via an Access Point.

8.4.1. Installing the SA-10 PRO Station Adapter

The ***BreezeNET SA-10 PRO*** Station Adapter implements plug-and-play

installation. All you need to get up and running is to connect the Station Adapter to the power supply and to your computer.

You can verify that the Station Adapter is fully operational by checking the LED indicators as described in "Front Panel LED Indicators" on page 8-5.

To complete the installation process you need, in addition to the supplied equipment, a standard CAT 5 UTP cable with RJ-45 connectors.

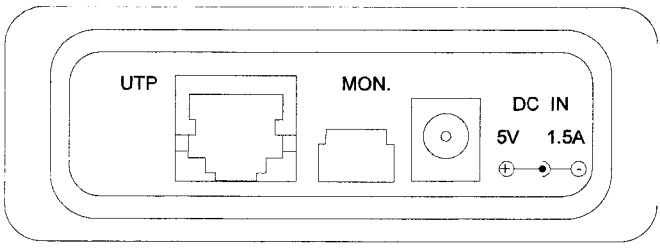


Figure 8.1: SA-10 PRO Station Adapter Rear Panel

Step 1
Position Your Station Adapter

For best results, choose a position for your Station Adapter while taking the following into consideration:

Metal Furniture

Position your Station Adapter well clear of metal furniture and away from moving objects such as metallic fans or metallic doors.

Microwave Ovens

Make sure that your Station Adapter is well clear of radiation sources that emit in the 2.4 GHz frequency band, such as microwave ovens.

Antennas

Make sure the antennas are extended vertically in relation to the floor, or, for SA-10D PRO models, connect the external antennas and RF cable.

Heat Sources

Keep your SA-10 PRO Station Adapter away from sources of heat such as radiators or ventilation outlets.

Step 2
Connect the SA-10 to the power supply.

The unit operates on a power input of 5v DC, (1200mA). This is supplied by the power transformer included with the unit.

- Plug the output jack of the power transformer into the DC input socket on the rear panel of the SA-10 PRO Station Adapter.
- Connect the power transformer to an external power outlet - 110/220v AC.

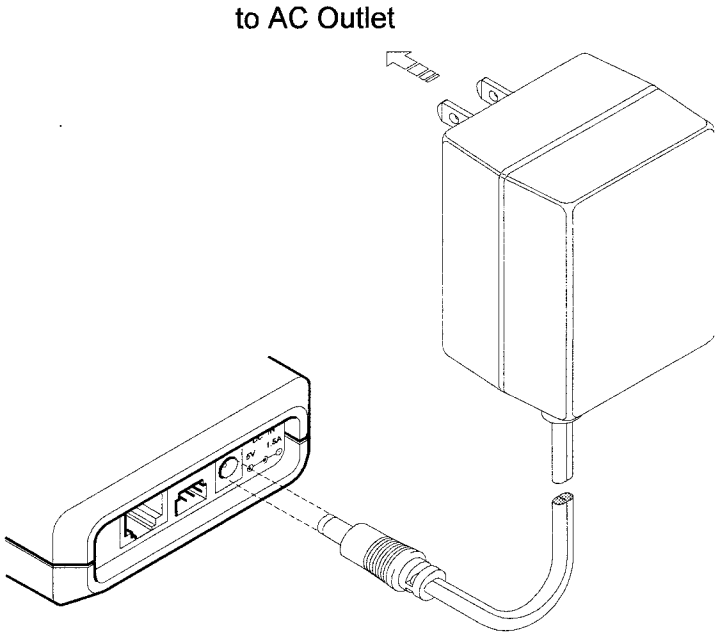


Figure 8.2: Connecting to the Power Supply

Step 3
Connect the SA-10 PRO to your computer or workstation.

- Connect the RJ-45 connector at one end of a regular (uncrossed) Ethernet cable, to the UTP port on the rear panel of the SA-10 PRO.

- Connect the RJ-45 connector on the other end of the Ethernet cable to the input socket of the Ethernet Network Interface Card on the rear panel of your computer.

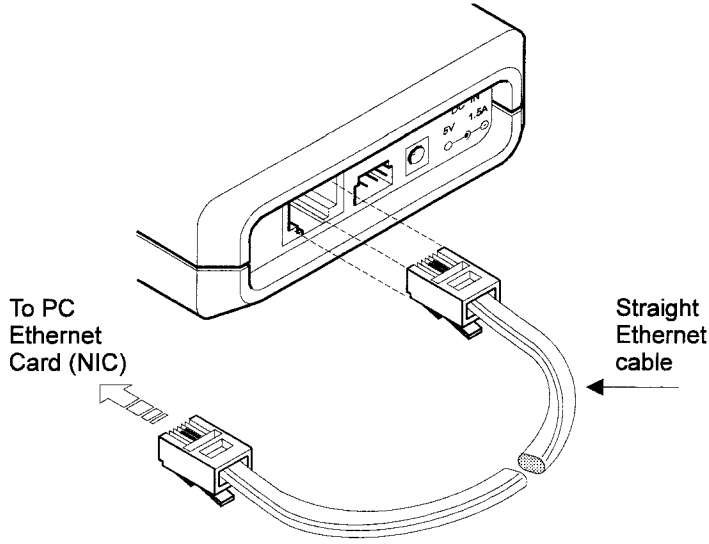


Figure 8.3: Connecting the SA-10 PRO to a Workstation

Step 4
Check functionality using the LED indicators.

Check the following aspects of SA-10 PRO functionality using the LEDs on the front panel.

- Power supply
- Wireless LAN link established by synchronization with an Access Point
- Ethernet activity
- Reception quality

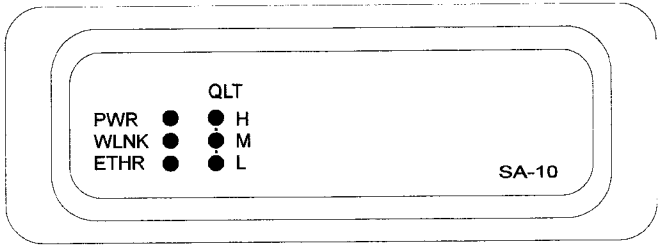


Figure 8.4: SA-10 PRO Front Panel LED indicators

Front Panel LED Indicators

1. **PWR** (Power supply; Power on test)
   - Off- During power off
   - On- After successful power on
2. **WLNK**
   - Off- Scanning for AP
   - On- Synchronized with AP
3. **ETHR**
   - Off- No activity on the Ethernet port
   - Blinks- Activity on the Ethernet port
4. **QLT**(L,M,H))

Very low quality reception

Low quality reception

Medium Quality Reception

High Quality Reception

Note: *The QLT LEDs do not light if the Station is not synchronized with an Access Point as well as when reception quality is very low.*

8.4.2. Associating with an Access Point

After installation, your ***BreezeNET SA-10 PRO*** Station Adapter automatically begins scanning for an Access Point in the area. If there is more than one Access Point, it searches for the Access Point which offers the best reception. Once an Access Point is located, the Station Adapter synchronizes itself with the Access Point.

When the PC begins sending out Ethernet packets through the SA, the AP learns the PC's source address from the first packet. In this way the SA is associated with the AP. From this moment on, the AP forwards frames from the Ethernet LAN only to the associated station.

Once association is established you can communicate with all the other wireless stations in the cell and, via the Access Point's Ethernet connection, with all the network facilities.

Note: *The SA-10 is able to associate with the AP only if their ESSIDs are identical.*

The Access Point, together with all Station Adapters associated with it, constitute a basic ***BreezeNET PRO*** cell.

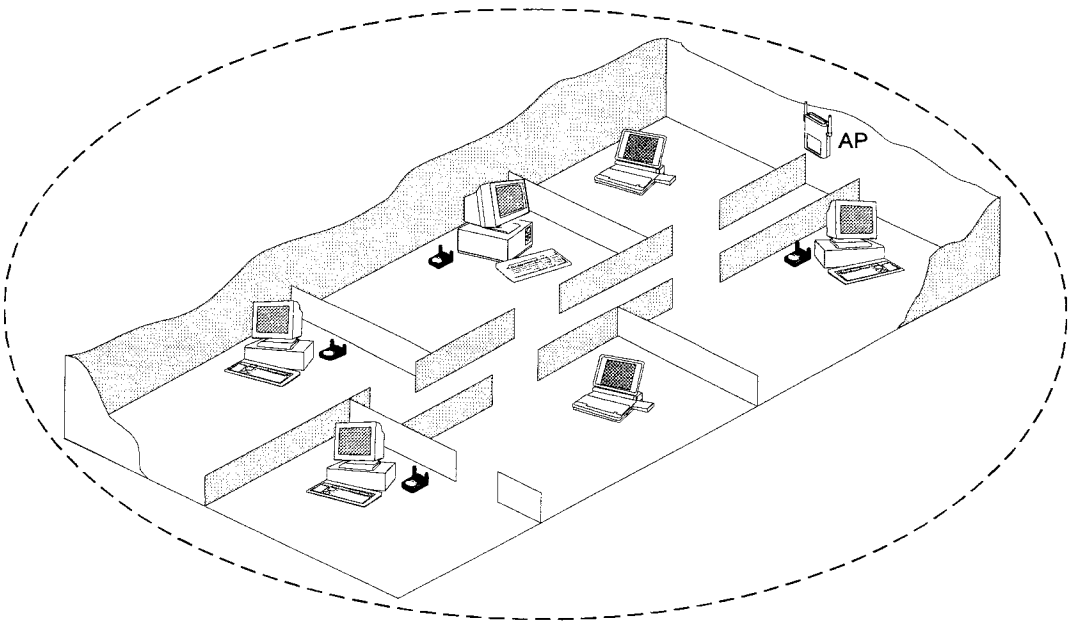


Figure 8.5: The Basic BreezeNET Cell

8.4.3. Associating with Other Access Points

When two or more adjacent Access Points are positioned close enough to each other, a part of their coverage areas overlaps. In high traffic density areas, Access Points are sometimes positioned so that *all* of their coverage areas overlap, creating a multicell. A workstation situated in an overlapping coverage area can associate with any one of the covering Access Points.

The Station Adapter automatically selects with which Access Point to associate. However, if your workstation is located within a coverage area of more than one Access Point and reception quality is low, you may improve reception by moving your station to a slightly different location. This takes advantage of a clearer or less busy connection to another Access Point.

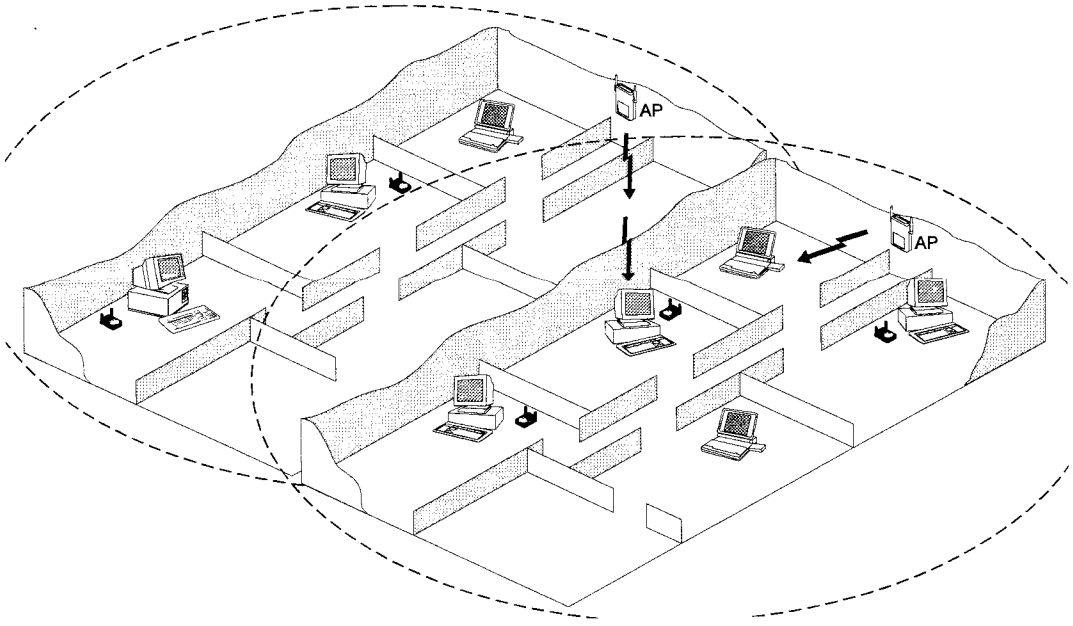


Figure 8.6: Associating with Different Access Points

8.5. Management

The ***BreezeNET PRO*** product line has been designed as a plug and play solution, and operates without any user intervention. However, users wishing to change some of the default parameters can do so to get additional functionality. There are two ways to set the parameters and/or the monitoring status of the station:

- Using a local terminal.
- Using an SNMP Management Information Base.

8.5.1. Local Terminal Management

Procedures for configuring ***BreezeNET SA-10 PRO*** Station Adapter setup and configuration menus can be found in section 4.1., "Local Terminal Management".

8.5.2. SNMP Management

The BreezeNET PRO Access Points and Station Adapters contain an embedded SNMP agent. Refer to section 4.2., "SNMP Management".

9. SA-PC PRO PC CARD ADAPTER

9.1. Package List

- ***BreezeNET PRO*** SA-PC Card Adapter
- 3.5-inch Network drivers installation disk
- SA-PC PRO Card Quick Installation Guide

9.2. Technical Specifications

See the table in Section 6, "Technical Specification" for the technical specifications of all products in the ***BreezeNET PRO Series***.

9.3. Quick Installation

Quick Installation is for experienced installers and network administrators (see Appendix A for the Quick Installation Guide). All others should continue on to the next section, "Installation".

9.4. Installation

Before you can operate the BreezeNET PRO PC Card, you need the following:

- A laptop, notebook or personal computer with a PCMCIA Type II slot which conforms to the February 1995 PC Card standard.
- Card and Socket Services for use with the PC Card. This is a must for Novell Netware users. If Card and Socket Services are not available on your computer, contact your computer manufacturer or dealer.

9.4.1. Inserting the SA-PC PC Card.

Note: You do not have to power down the PC before inserting the ***BreezeNET PRO*** *PC Card.*

⇒ ***To insert the BreezeNET PRO SA-PC Card:***

1. Hold the PC card by the edges. Verify that the ***BreezeNET PRO***

Series logo is facing up.

2. Insert the end of the card displaying "Insert this End" into a PCMCIA slot. Refer to your computer manual for the exact location of the PCMCIA slot. You may feel a slight resistance as you slide the PC Card into the slot. This is normal. Push the card firmly into the slot until it is fully inserted.

3. Gently raise the integrated hinged antenna until it is at a 90° angle to the base of the card. The two LED displays on the antenna assembly indicate wireless LAN transmit and receive activity.

   - The upper LED indicates that the SA-PC is receiving data over the wireless network.
   - The lower LED blinks when the card is transmitting to the wireless network.

9.4.2. Network Software Installation

The installation disk supplied with the SA-PC PRO Card includes drivers for installing the card in the following environments:

- Windows 95
- Windows NT
- Novell NetWare

Installing in a Windows 95 Environment

Use the SA-PC Card Network Drivers disk to install the SA-PC Card in a Windows 95 environment.

⇒ ***To install the BreezeNET PRO SA-PC Card in a Windows 95 Environment:***

1. Turn the laptop or other computer on and start Window 95 if it does not start automatically.

2. Insert the SA-PC Card into one of the PCMCIA slots in the laptop computer. If inserted into the bottom slot, the extended form of the SA-PC Card prevents the insertion of another card into the upper slot. Therefore it is advisable to insert the card into the upper slot.

3. Windows 95 displays a notification window informing the user that it has detected the SA-PC card and prompts you to select the driver to install the hardware.

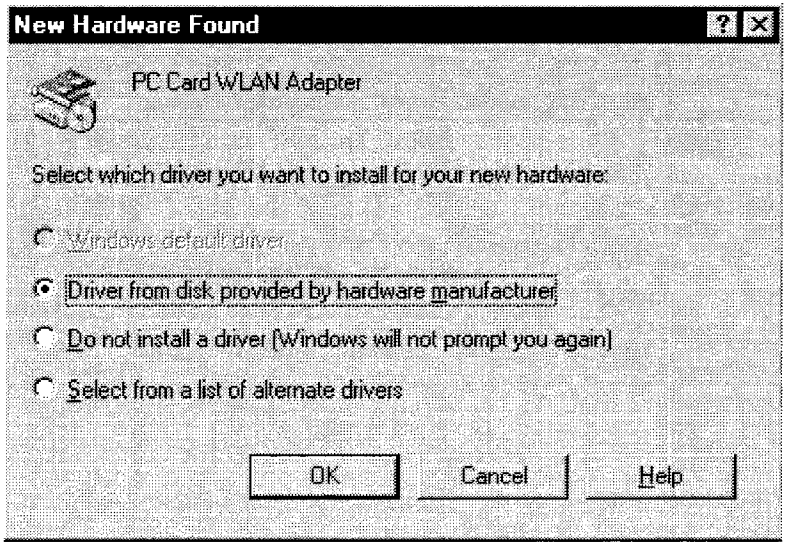


Figure 9.1: New Hardware Found Dialog Box

4. The default is "Driver from disk provided by hardware manufacturer". Click OK. The Install from Disk window appears.

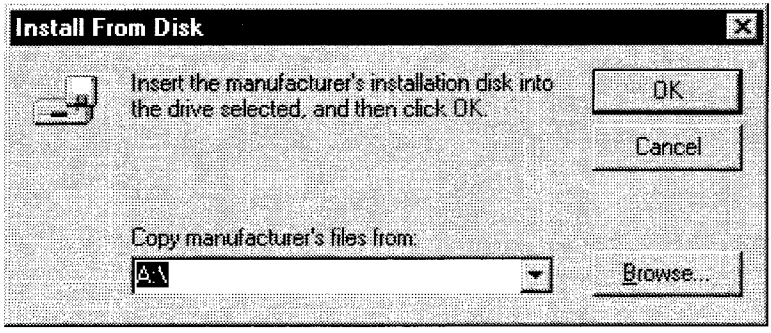


Figure 9.2: Install From Disk window

5. Insert the SA-PC Network Drivers disk in drive A and click OK. Windows 95 loads the driver and the network properties screen for the wireless adapter appears. You should see a screen similar to this:

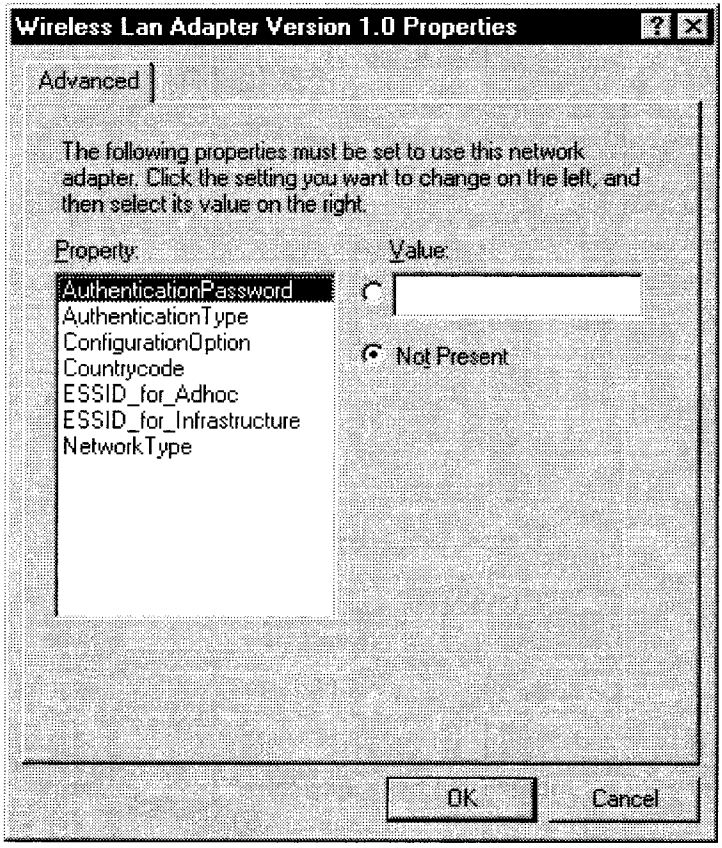


Figure 9.3: Properties Dialog Box

6. Set network properties as follows:

   - Authentication Password - this is set by the System Administrator when the Authentication type is set to "password". Otherwise, this should be "not present".
   - Authentication Type - If no password is needed, set to "open". If a password is needed to log in to the network, set to "password".

- Configuration Option - set to B
- Country code - Set based on geographic area. The options are: USA, Europe, Japan and Korea.
- ESSID_for_Adhoc - set to a unique name to subdivide the workgroup. The ESSID can consist of up to 32 alphanumeric characters. This field is forced into upper case. No spaces are allowed. All devices on the wireless LAN must have the same ESSID in order to communicate with each other. Set the ESSID to the same value as that set in the other stations making up the Ad Hoc network. The default is ADHOC_ESSID.
- ESSID_for_Infrastructure - Set the ESSID to the same value as that set in your Access Point. The default is ESSID1.
- Network Type - select Infrastructure to connect to an Access Point, select Ad-Hoc for peer-to-peer networking. The default is ADHOC_AFTER_INFRASTRUCTURE. This option first searches for an Access Point. If one is not found, it searches for an Ad Hoc network. Leave the default option to cover all networking possibilities.

7. When you finish setting the properties, click OK.
8. Remove the Network drivers disk from the floppy disk drive and reboot the machine, or:

⇒ ***To set up a TCP/IP network:***

1. Right-click on Network Neighborhood and select Properties from the menu which appears.
2. Click the Adapter tab,select the TCP/IP > Wireless LAN Adapter and click Properties.
3. Specify the appropriate IP address and Gateway.
4. Click OK and restart your computer.

⇒ ***To retrieve the network properties of the Wireless Adapter:***

1. In the Control Panel, double-click on Networks. The Network Properties screen is displayed.
2. Click on "Wireless LAN Adapter" and then click on Properties. Click the Advanced tab.
3. Make any required changes and click OK.

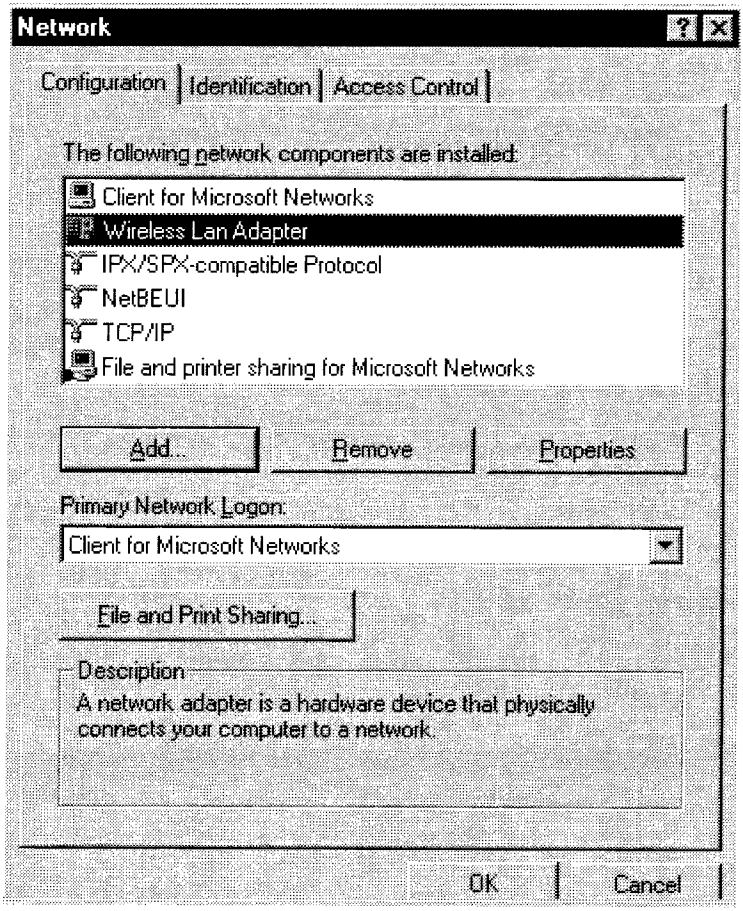


Figure 9.4: The Network Dialog Box

⇒ ***To configure the Network:***

1. First install one or more clients, as required.
   - For ad-hoc networks, install Client for Microsoft Networks.
   - For infrastructure networks (associating with an AP) install a client that supports TCP/IP, NetBEUI or SPX/IPX communications.

   Refer to Windows 95 installation instructions for how to install the client.

⇒ ***To enable resource sharing:***

For Network resources to be visible to the users, they must be shared.

- In a server-based network architecture, these are the server resources (files, printers, etc.).
- In an ad-hoc network, individual client resources (files, folders and printers) must be shared to make that client visible on the network.
  - Click on *File and Print Sharing* to enable sharing of resources (file and printer sharing).

⇒ ***To set Network Identification:***

1. In the Network Dialog Box, click on the Identification tab. The following screen appears:

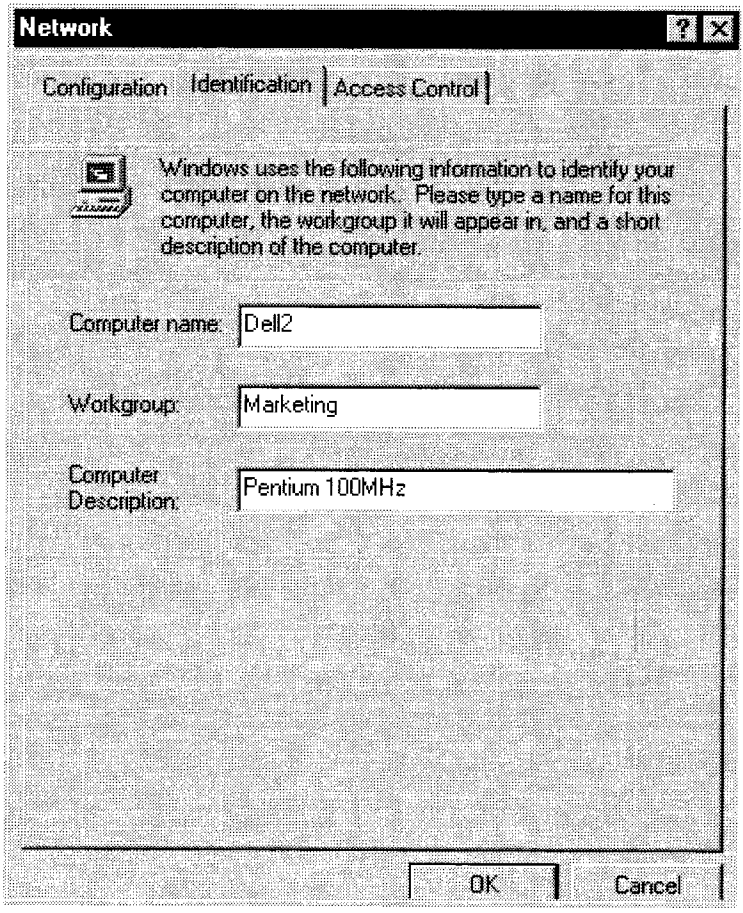


Figure 9.5: Network Identification Dialog Box

2. Type the computer name. This name must be unique and not shared by any other computer on the network. The name is case-sensitive.

3. Type in the workgroup name for the computers and printers in the workgroup. This name is also case-sensitive and must be the same for all computers and peripheral equipment in the group or network.

Windows 95 Installation Troubleshooting

Drivers and devices loaded in autoexec.bat and config.sys may cause conflicts with the PC card drivers. If the card does not function properly, check the Device Manager for conflicts

⇒ ***To check for conflicts:***

1. In the Network dialog box, click the Adapters tab and verify the status of the Wireless LAN Network. An exclamation mark next to the card indicates a conflict.
2. Look for device drivers or lines containing device or call commands in autoexec.bat and/or config.sys.
3. Disable the conflicting drivers and devices and reinstall the card.

Installing in a Windows NT Environment

The procedure for installing the SA-PC PRO Card in a Windows NT environment is very similar to that used when installing in a Windows 95 environment.

Before you begin installation procedures, run NT Diagnostics to check which IRQs and MEM regions are in use. If you choose a region that is already being used, this may result in conflicts with other applications or hardware.

⇒ ***To check which IRQs and MEM regions are in use:***

1. Click Start and then click Programs.
2. In the Programs menu, click Administrative Tools and then click NT Diagnostics.
3. In the NT Diagnostics dialog box, click the Resources tab. A list of IRQs currently in use is displayed.

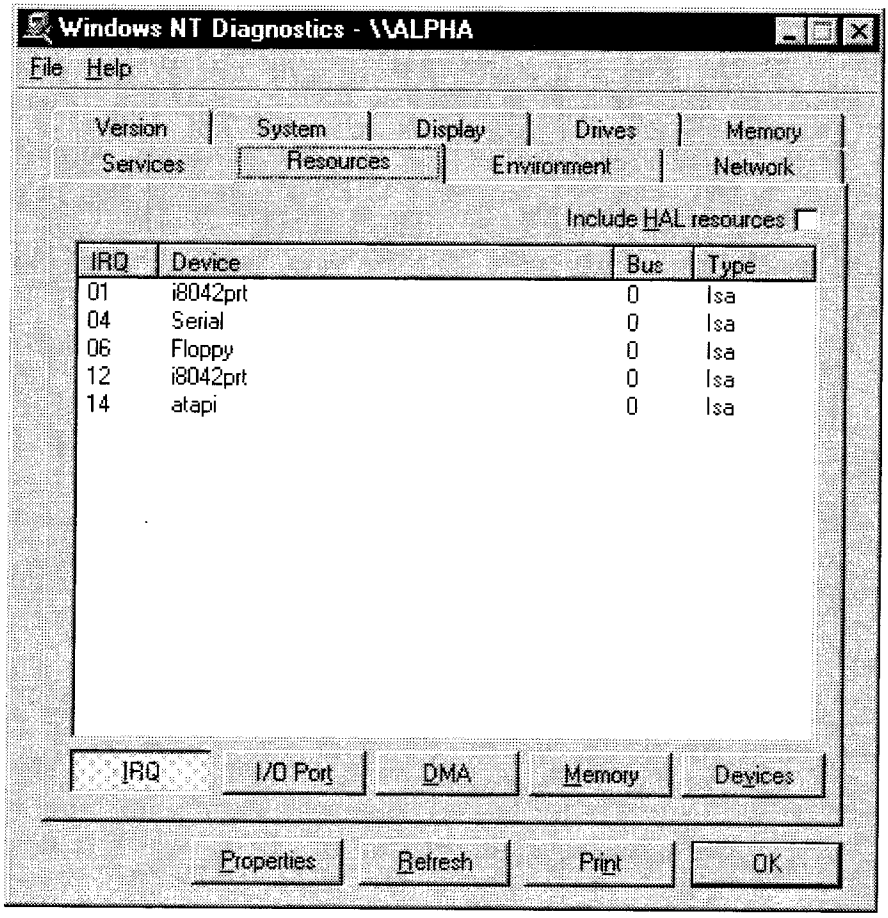


Figure 9.6: NT Diagnostics dialog box displaying IRQs in use

4. Make a note of the IRQs in use and then click the Memory button. The NT Diagnostics dialog box now displays a list of Memory regions currently in use.

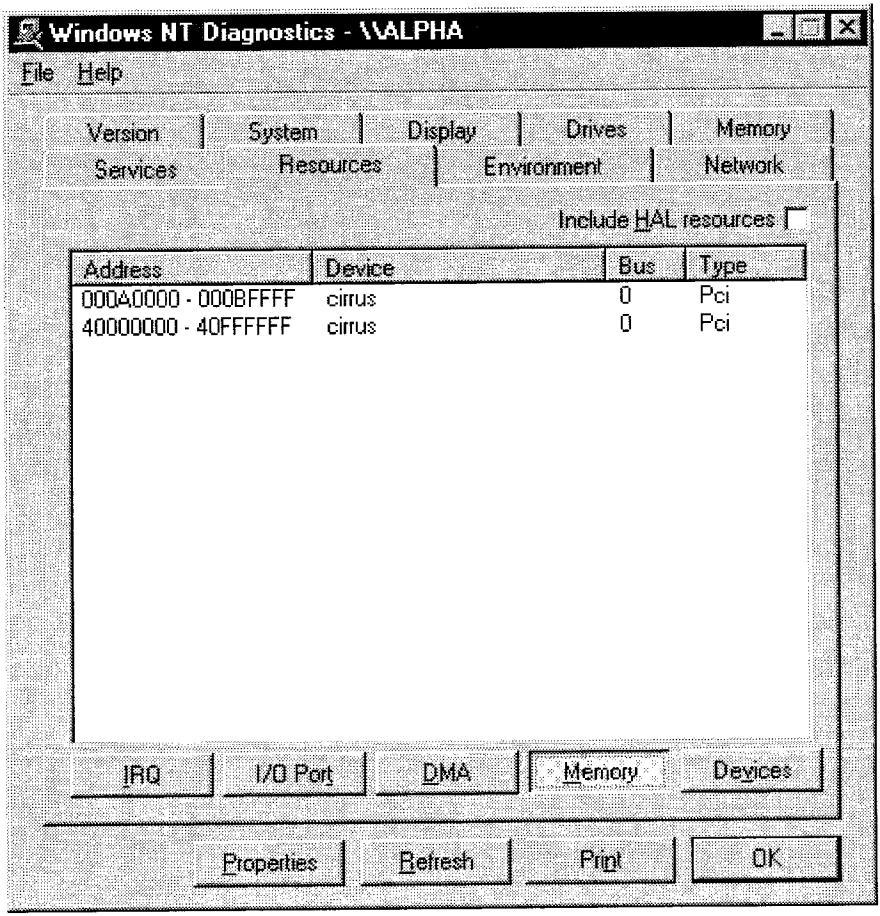


Figure 9.7: NT Diagnostics dialog box displaying MEM regions in use

5. Make a note of the addresses in use and click OK. You are now ready to install the SA-PC PRO Card.

⇒ ***To install the SA-PC PRO Card in a Windows NT environment:***

1. Insert the SA-PC Card into one of the PCMCIA slots in the laptop computer. If inserted into the bottom slot, the extended form of the SA-PC Card prevents the insertion of another card into the upper slot. Therefore it is advisable to insert the card into the upper slot.

2. Turn the laptop or other computer on and start Windows NT if it does not start automatically.

3. Right-click Network Neighborhood.

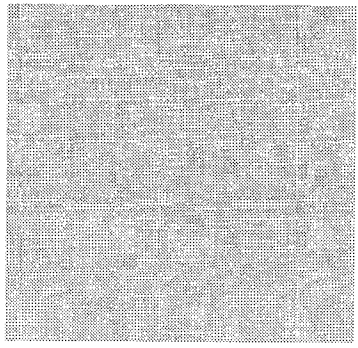


Figure 9.8: The Network Neighborhood menu

4. In the menu that appears, click Properties. The Network dialog box is displayed.

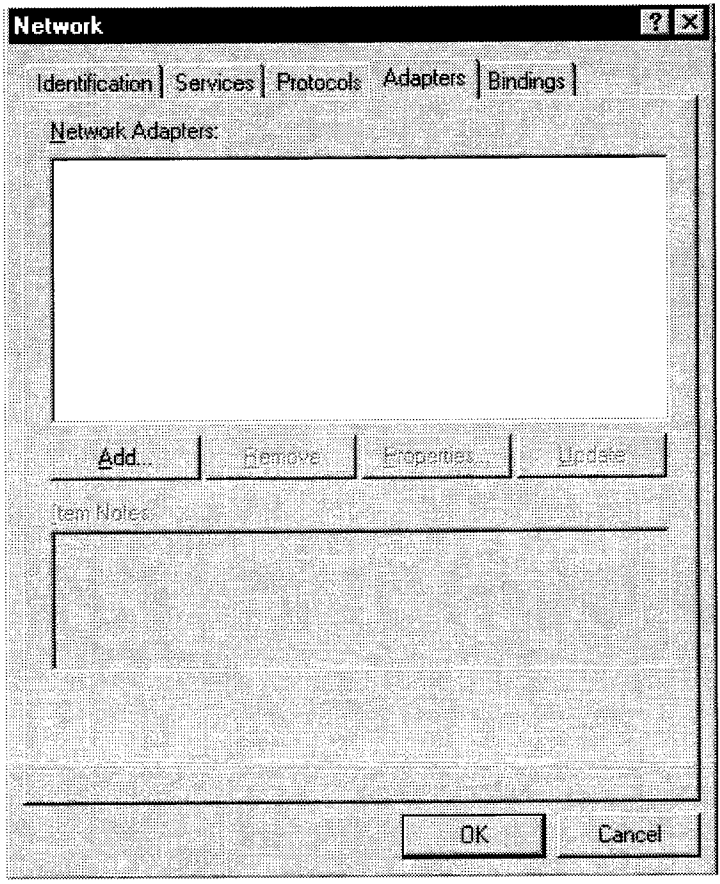


Figure 9.9: Windows NT Network dialog box

5. Click the Adapters tab and then click Add. The Select Network Adapter dialog box is displayed.

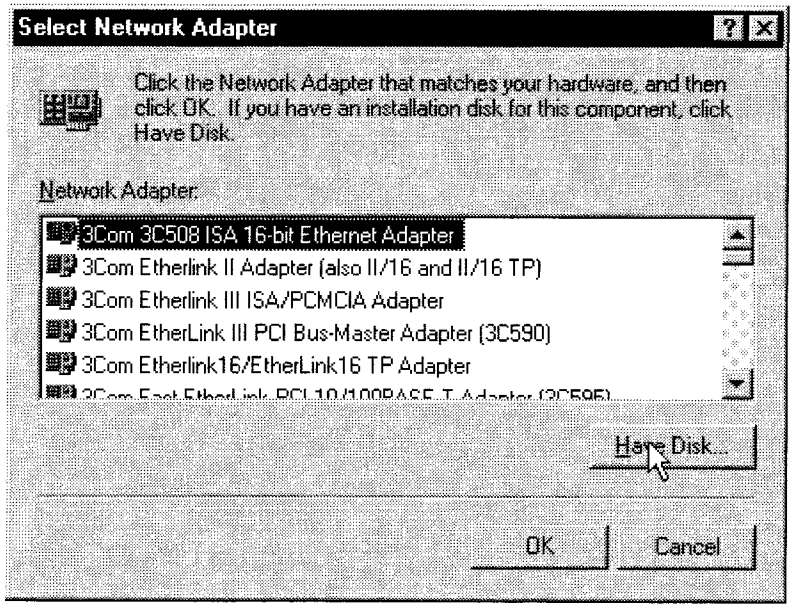


Figure 9.10: The Select Network Adapter dialog box

6. Insert the provided installation disk and click "Have Disk". The Insert Disk window appears prompting you to type in the location of the files. Type: A:\ at the cursor.

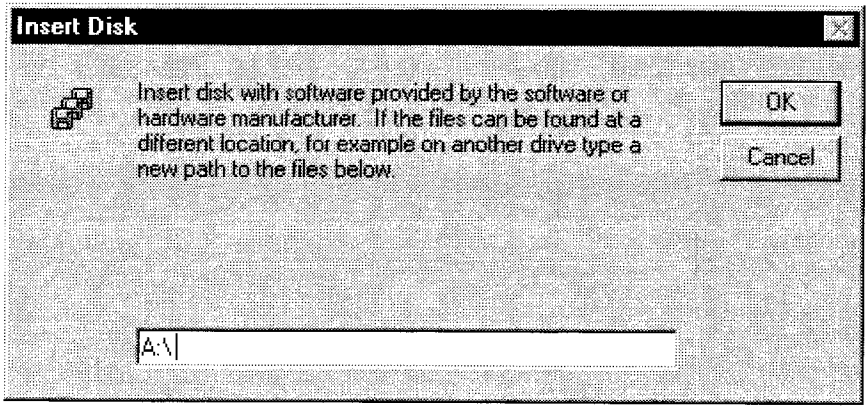


Figure 9.11: The Insert Disk window

7. The system identifies the driver from the disk and the Select OEM Option dialog box appears.

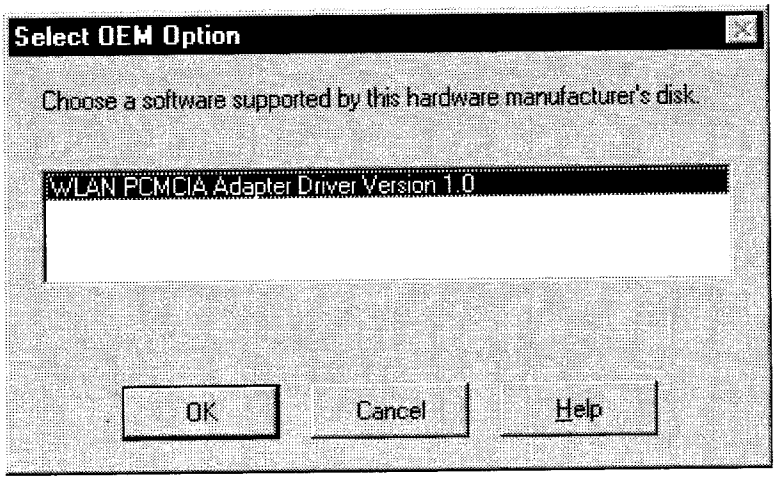


Figure 9.12: The Select OEM Option dialog box

8. Click OK. The Bus Location dialog box appears. Open the drop-down list in the Type field and select PCMCIA. Click OK.

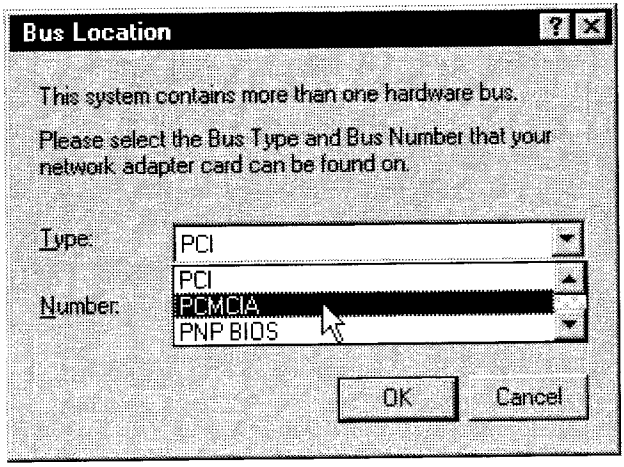


Figure 9.13: The Bus Location dialog box

9. The Card Setup dialog box is displayed.

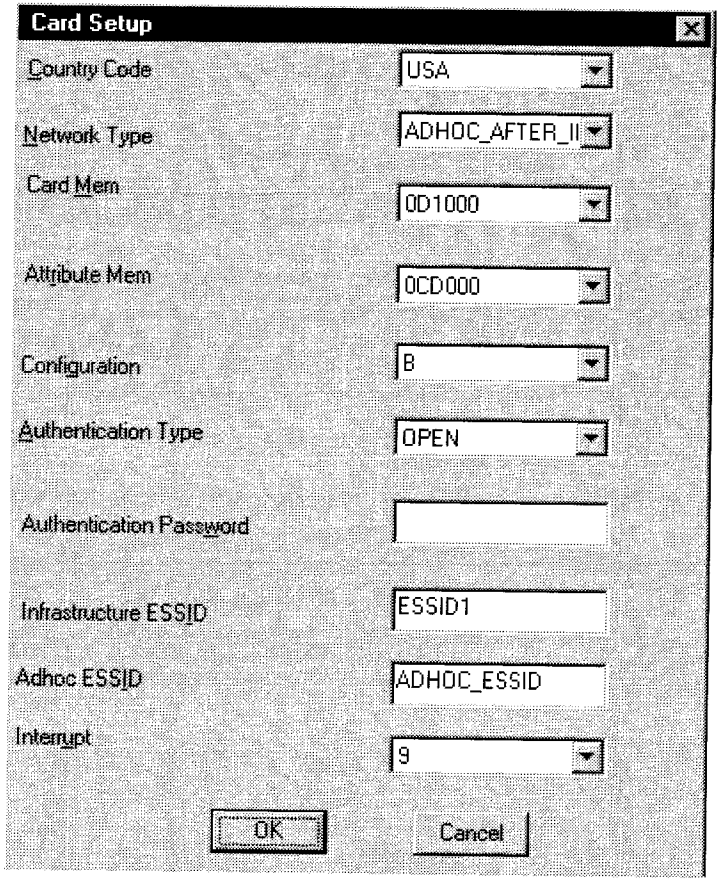


Figure 9.14: Card Setup dialog box

10. Configure the Card Setup dialog box as follows:

- Change Configuration from the default value of A to **B**.
- Set the ESSID to the same as that set in the Access Point.
- The default Network Type is AD HOC AFTER INFRASTRUCTURE. The system first searches for infrastructure networking (associating with an AP). If this is not found, it searches for ad-hoc, peer-to-peer networking. This default option covers all networking possibilities. There is no need to select any other option.

- In the Card Memory, Attribute Memory and Interrupt fields, in order to avoid conflicts, make sure not to select regions that are already being used by other devices (see "To check which IRQs and MEM regions are in use:" on page 9-9).

11. Click OK. The Network dialog box reappears displaying the new adapter.

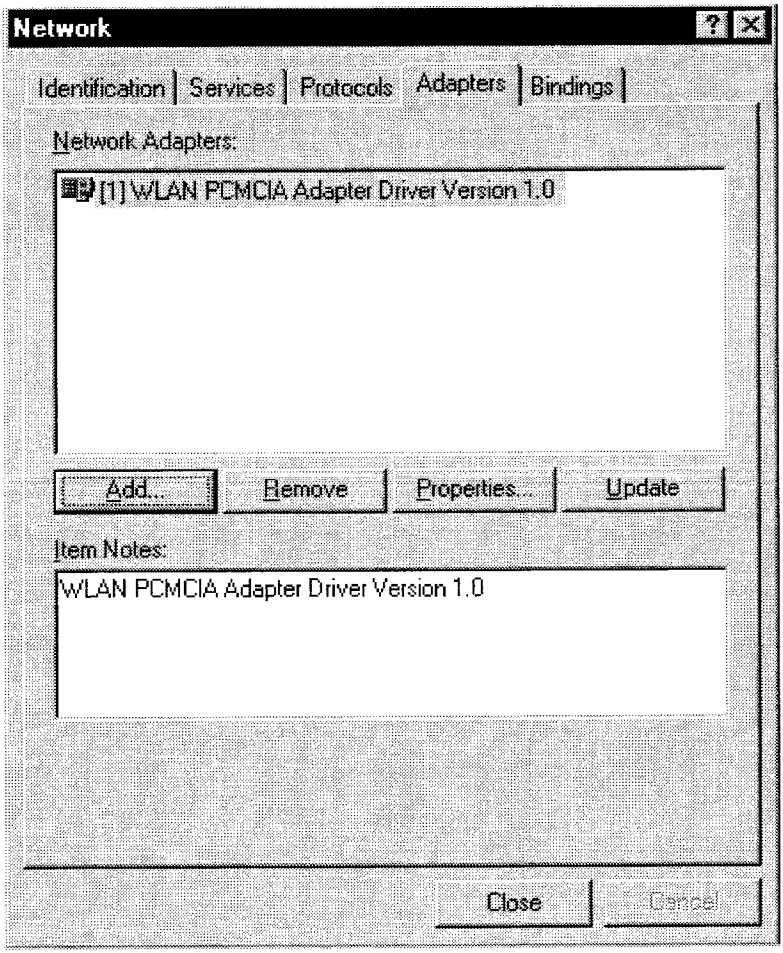


Figure 9.15: The Network dialog box

12. Click Close. The system automatically identifies networking protocols. If you are prompted for any configuration parameters, please consult your System Administrator. At the end of the

procedure, the system displays the Network Settings Change dialog box.

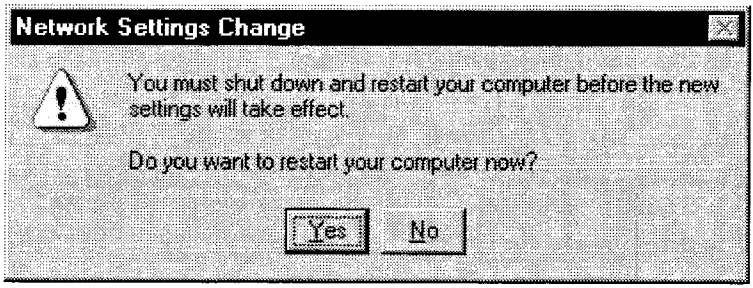


Figure 9.16: Network Setting Change window

13. For your new settings to take effect, Click YES to reset the unit. Remember to remove the installation disk before you click YES.

Windows NT Installation Troubleshooting

If the card is not functioning after what appears to be a successful installation, check the Event Detail dialog box to determine what the problem is.

⇒ ***To access the Event Detail dialog box:***

1. Click Start and then click Programs.
2. From the menu that appears, select Administrative Tools (Common).
3. Click Event Viewer. The Event Detail dialog box appears displaying details of the event.

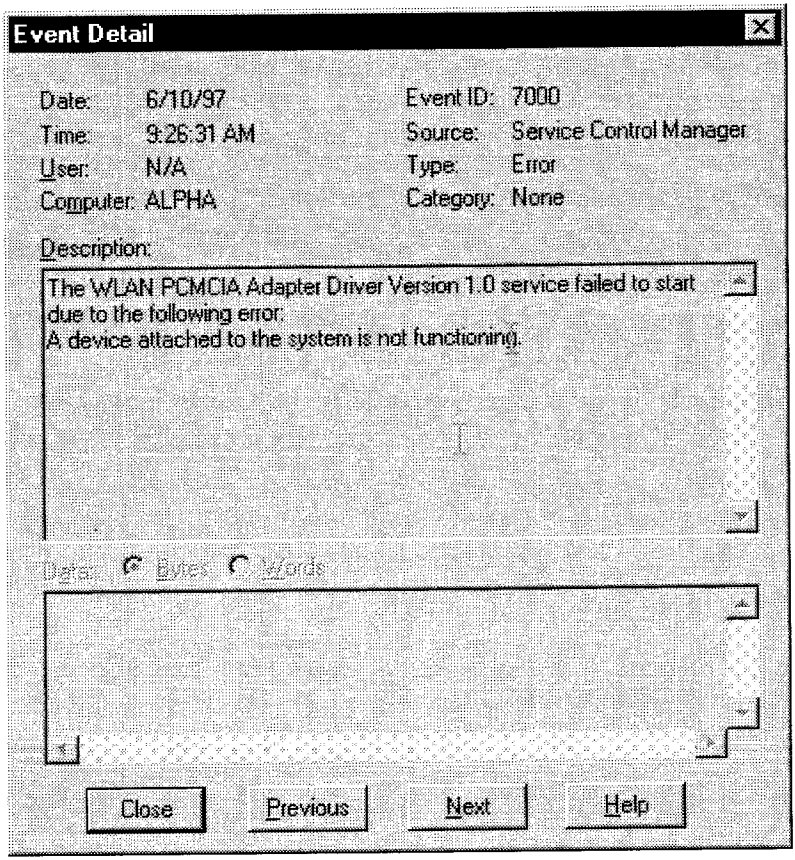


Figure 9.17: Windows NT Event Detail dialog box

4. Make sure that there are no conflicts with other devices due to usage of the same IRQs and/or MEM regions (see "To check which IRQs and MEM regions are in use:" on page 9-9).

5. Re-access the Card Setup dialog box and in the Card Memory, Attribute Memory and Interrupt fields and select parameters that are not in use by other devices.

Installing in a Novell NetWare Environment ODI Driver

When installing in a Novell NetWare environment, card and socket services must be installed on your laptop to operate the SA-PC PRO Card.

Memory Allocation Guidelines

The following recommendations are provided concerning memory addresses and exclusions. Your computer manufacturer may use or recommend other addresses.

Use an extended memory manager such as EMM386.EXE and set arguments to exclude the 0XD0000-0XDFFFF memory range in order to prevent conflicts between the SA-PC Card and other devices. An example of this exclusion is to use the device driver statement in the CONFIG.SYS file as follows:

DEVICE=C:\WINDOWS\EMM386.EXE NOEMS X=D000-DFFF

⇒ ***To install the SA-PC PRO Card:***

1. Carefully insert the SA-PC PRO card into a Type II PCMCIA slot in the computer.
2. Copy the following files located under the ODI directory in the included SA-PC card installation disk to a new directory:
   - Nesl.com
   - Net.cfg
   - R128D.com

The Net.cfg file contains information for custom parameters for networks using the ODI driver. You can use an ASCII text editor to modify the file manually. The net.cfg file is usually located in the \NWCLIENT directory.

Sample net.cfg file:

Link Support
Buffers 8 1500
MemPool 4096
Max Stacks 4
show dots=on
max task=40

```
cache buffers=10
file handles=80

Protocol IPX
  Bind 1

Link driver raylink

; NODE ADDRESS 001122334466L
  FRAME Ethernet_802.3

        DOMAIN      USA
        NET_TYPE    infrastructure
        NET_ENTRY JOIN
        CONFIGURATION   OPTION_B
        ESSID       "ESSID1"

NetWare DOS Requester

        FIRST NETWORK DRIVE = f
```

Net.cfg Keywords:

Keyword	Default	Options
AUTH_TYPE	OPEN	(OPEN,PASSWORD)
AUTH_PASSWORD	OPEN	(OPEN, 15 CHARACTERS)
DOMAIN	USA	(USA, EUROPE,JAPAN,KOREA)
ESSID	ESSID1	(NO MORE THAN 32 CHARACTERS)
NET_ENTRY	JOIN	(JOIN=INFRASTRUC-TURE, START=AD HOC)
NET_TYPE	INFRASTRUCTURE	(INFRASTRUCTURE, ADHOC)
POWER_MODE	CAM	(CAM,PSN)
STA_TYPE	STATION	(STATION, AP)

3. Copy Lsl.com, Ipxodi.com, and Vlm.exe (if available) from your Novell client directory to the same directory you created in the previous step.

4. Create a new file named Startnet.bat in the new directory created in step 2. Include the following command (in this order): lsl,nesl,r128d,ipxodi and vlm (if available).

   - Sample Startnet.bat file:

```
@ECHO OFF
C:
CD\NWCLIENT
SET NWLANGUAGE=ENGLISH
LSL
NESL
R128D.COM
IPXODI
VLM
CD\
```

5. Edit your Autoexec.bat file and insert the Startnet.bat command. Verify that, when run, it skips all other existing Ethernet PCMCIA drivers.

6. Reboot your computer, start the network and log in at the login prompt.

⇒ ***To install Novell Personal NetWare***

1. Install Personal NetWare according to the instructions in the Personal NetWare documentation.

2. When prompted for the network adapter type, select "OEM supplied driver" and complete the installation.

3. When prompted for the driver files, insert the BreezeNET PRO SA-PC Network Drivers disk into the 3.5-inch floppy disk drive. Specify the path A:\ where A: is the drive where the disk is located.

4. Remove the disk from the floppy drive and reboot the PC.

9.4.3. Associating with an Access Point

After installation, your ***BreezeNET PRO*** SA-PC Card Adapter automatically begins scanning for an Access Point in the area. If there is more than one Access Point, it searches for the Access Point which offers the best reception. Once an Access Point is located, the SA-PC synchronizes itself to the frequencies being used, and establishes association with the Access Point.

When the PC begins sending out Ethernet packets through the SA-PC, the AP learns the PC's source address from the first packet. In this way the SA-PC is associated with the AP. From this moment on, the AP forwards frames from the Ethernet LAN to the associated station.

Once association is established you can communicate with all the other wireless stations in the cell and, via the Access Point's Ethernet connection, with all the network facilities.

The Access Point, together with all adapters associated with it, constitute a basic ***BreezeNET PRO*** cell.

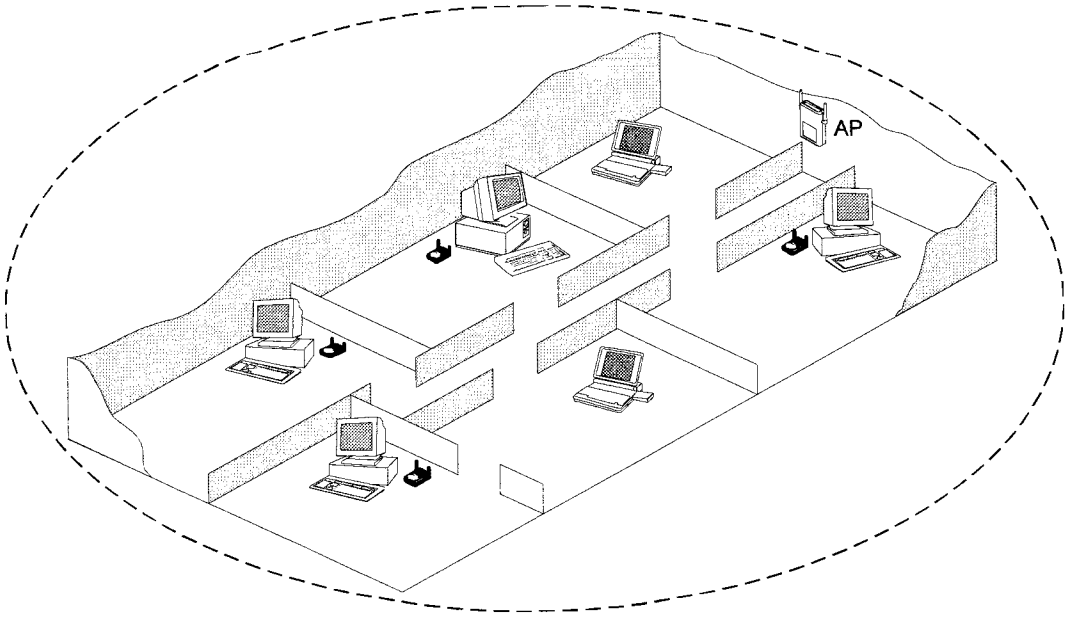


Figure 9.18: The Basic BreezeNET Cell

9.4.4. Associating with Other Access Points

When two or more adjacent Access Points are positioned close enough to each other, a part of their coverage areas overlaps. In high traffic density areas Access Points are sometimes positioned so that *all* of their coverage areas overlap, creating a multicell. A laptop situated in an overlapping coverage area can associate with any one of the covering Access Points.

The PC Card automatically selects with which Access Point to associate. However, if your laptop is located within a coverage area of more than one Access Point and reception quality is low, you can improve reception by moving your laptop to a slightly different location. This takes advantage of a clearer or less busy connection to another Access Point

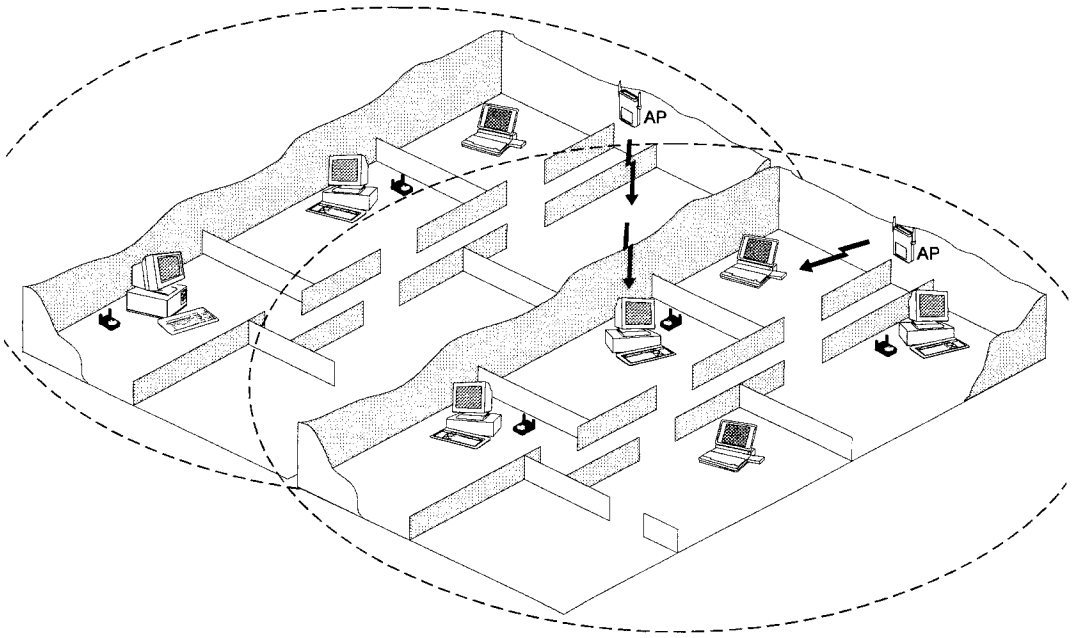


Figure 9.19: Associating with Different Access Point

10. SA-40 PRO FOUR PORT STATION ADAPTER

10.1. Package List

When you first open the ***BreezeNET SA-40 PRO*** Four Port Station Adapter, the package contains the following components:

- The ***BreezeNET SA-40 PRO*** Four Port Station Adapter, complete with two omni-directional antennas or RF connectors for use with external antennas ("D" model).
- The SA-40 PRO Quick Installation Guide.
- A 5V DC power supply transformer.
- A mounting bracket for wall or ceiling installations.

Open the packaging carefully and make sure that none of the items listed above are missing. Do not discard packaging materials. In case of return, the unit must be shipped in its original package.

10.2. Technical Specifications

See the table in Section 6, "Technical Specifications" for the technical specifications of all products in the ***BreezeNET PRO Series***.

10.3. Quick Installation

Quick Installation is for experienced installers and network administrators (see Appendix A for the Quick Installation Guide). All others should continue on to the next section, "Installation".

10.4. Installation

This section explains how to install the ***BreezeNET SA-40 PRO*** Four Port Station Adapter and how the Four Port Station Adapter automatically establishes connectivity with the wireless LAN via an Access Point.

10.4.1. Installing the SA-40 PRO Four Port Station Adapter

The ***BreezeNET SA-40 PRO*** implements plug-and-play installation. All you need to get up and running is to connect the SA-40 PRO to the power supply and to your computer.

You can verify that the SA-40 PRO is fully operational by checking the LED indicators as described in "Front Panel LED Indicators" on page 10-5.

To complete the installation process you need, in addition to the supplied equipment, an Ethernet connector cable with RJ-45 connector at each end.

Step 1
Position Your SA-40 PRO Four Port Station Adapter

When positioning your SA-40 PRO, take the following into consideration to attain the best results:

Metal Furniture

Position your SA-40 PRO clear of metal furniture and away from moving objects such as metallic fans or metallic doors.

Microwave Ovens

Make sure that your SA-40 PRO is well clear of radiation sources that emit in the 2.4 GHz frequency band, such as microwave ovens.

Antennas

Make sure the antennas are extended vertically in relation to the floor, or , for SA-40D PRO models, connect the external antennas and RF cable.

Heat Sources

Keep your SA-40 PRO away from heat sources such as radiators or ventilation outlets.

Step 2
Connect the SA-40 PRO to the power supply.

The unit operates on a power input of 5Vdc, (1200mA).This is supplied by the power transformer included with the unit.

- Connect the power transformer to an external power outlet - 110/220Vac.
- Plug the output jack of the power transformer into the DC input socket on the side of the SA-40 PRO.

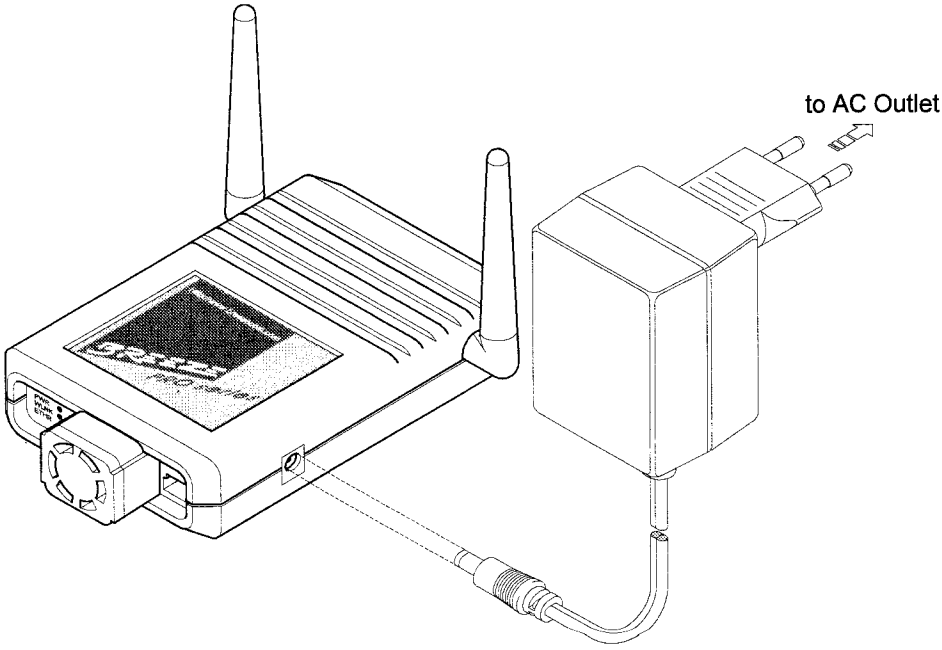


Figure 10.1: Connecting the SA-40 PRO to the power supply

Step 3
Connect the SA-40 PRO to your computer or workstation.

- Connect the RJ-45 connector at one end of a regular (uncrossed) Ethernet cable, to one of the UTP ports on the rear panel of the SA-40 PRO.
- Connect the RJ-45 connector on the other end of the Ethernet cable to the input socket of the Ethernet Network Interface Card on the rear panel of your computer.
- Repeat the previous action to connect up to four workstations.

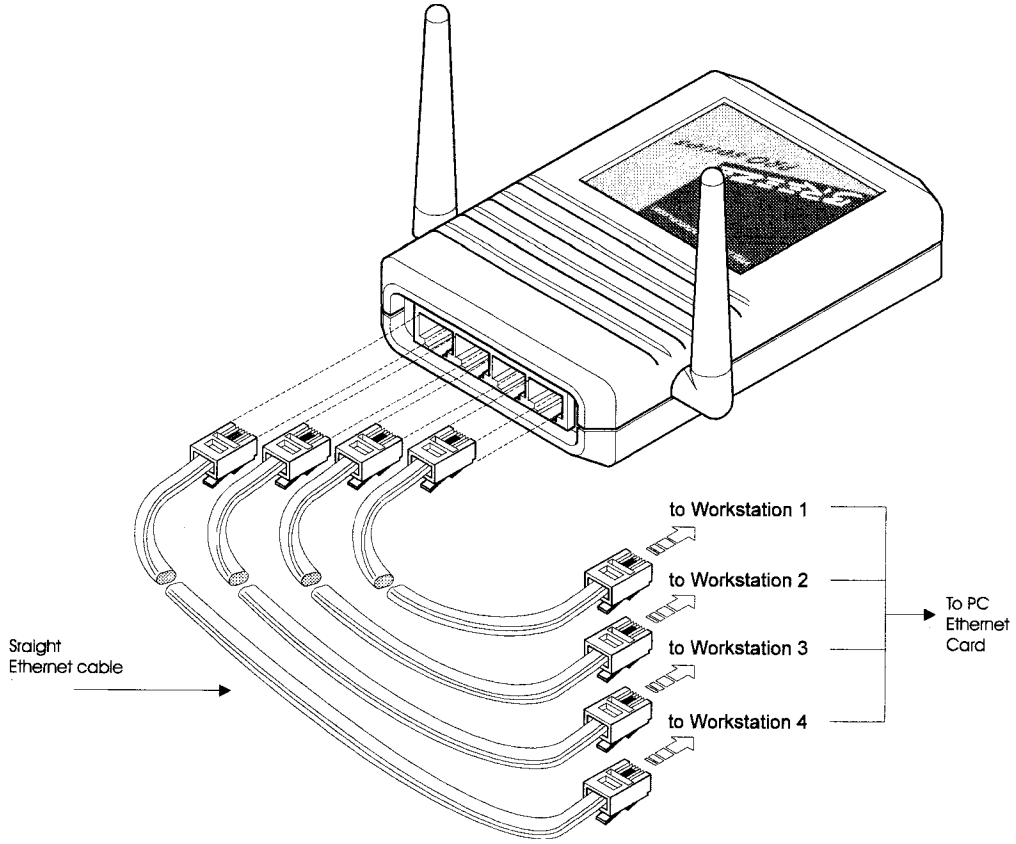


Figure 10.2: Connecting to the Ethernet hub

Step 4
Check functionality using the LED indicators.

Use the LEDs on the front panel to check the following SA-40 PRO functions:

- Power supply
- Wireless LAN link established by synchronization with an Access Point
- Ethernet activity
- Reception quality

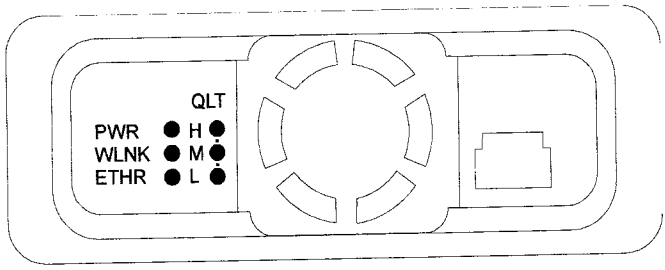


Figure 10.3: SA-40 PRO Front Panel LED Indicators

Front Panel LED Indicators

1. **PWR** (Power supply; Power on test)
   - Off- During power off
   - On- After successful power on
2. **WLNK**
   - Off- Scanning for AP
   - On- Synchronized with AP
3. **ETHR**
   - Off- No activity on the Ethernet port
   - Blinks- Activity on the Ethernet port
4. **QLT**(L,M,H))

Very low quality reception

Low quality reception

Medium quality reception

High quality reception

Note: *The QLT LEDs do not light if the Station is not synchronized with an Access Point as well as when reception quality is very low.*

10.4.2. Associating with an Access Point

After installation, your ***BreezeNET PRO*** Station Adapter automatically begins scanning for an Access Point in the area. If there is more than one Access Point, it searches for the Access Point which offers the best reception. Once an Access Point is located, the Station Adapter synchronizes itself with the Access Point.

When the PC begins sending out Ethernet packets through the SA, the AP learns the PC's source address from the first packet. In this was the SA associates itself with the AP. From this moment on, the AP forwards frames from the Ethernet LAN to the associated station.

Once association is established you can communicate with all the other wireless stations in the cell and, via the Access Point's Ethernet connection, with all the network facilities.

Note: *The SA-40 is able to associate with the AP only if their ESSIDs are identical.*

The Access Point, together with all Station Adapters associated with it, constitute a basic BreezeNET PRO cell.

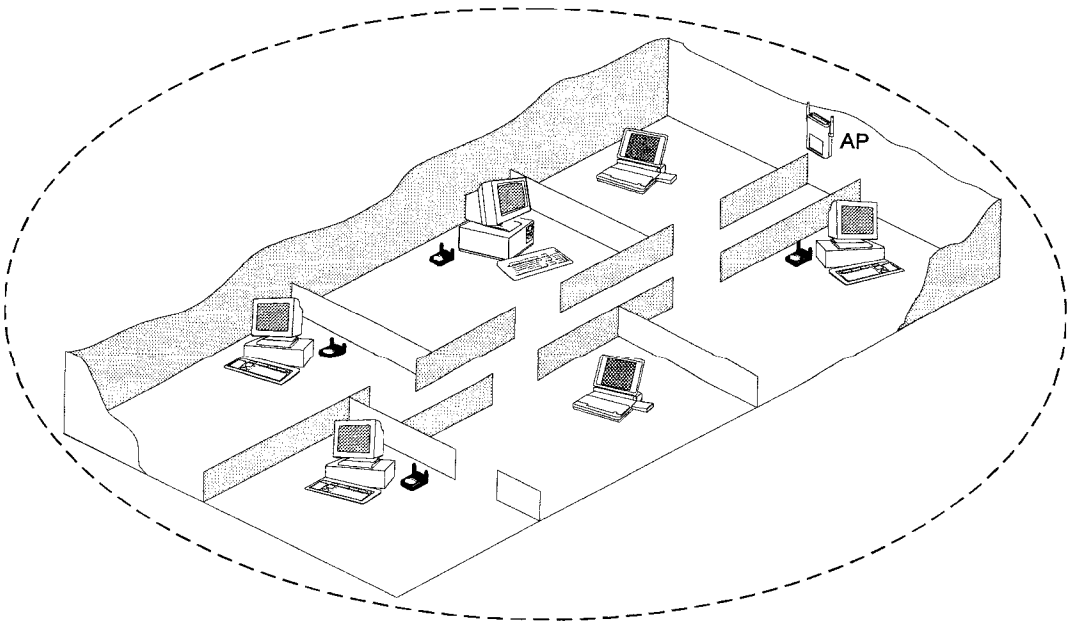


Figure 10.4: Basic BreezeNET PRO Cell

10.4.3. Associating with Other Access Points

When two or more adjacent Access Points are positioned close enough to each other, a part of their coverage areas overlaps. In high traffic density areas Access Points are sometimes positioned so that *all* of their coverage areas overlap, creating a multicell. A workstation situated in an overlapping multicell coverage area can associate with any one of the covering Access Points.

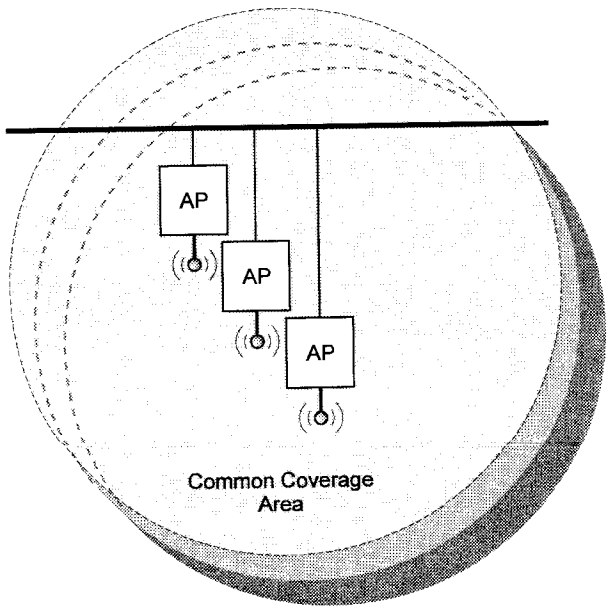


Figure 10.5: Multicell coverage area

The SA-40 PRO Four Port Station Adapter automatically selects with which Access Point to associate. However, if your workstation is located within a coverage area of more than one Access Point (multicell) and reception quality is low, you may improve reception by moving your station to a slightly different location. This takes advantage of a clearer or less busy connection to another Access Point

10.5. Management

The ***BreezeNET PRO*** product line has been designed as a plug and play solution, and operates without any user intervention. However, users

wishing to change some of the default parameters can do so to get additional functionality. There are two ways to set the parameters and/or the monitoring status of the station:

- Using a local monitor.
- Using an SNMP Management Information Base.

10.5.1. Local Terminal Management

Procedures for configuring ***BreezeNET SA-40 PRO*** Four Port Station Adapter setup and configuration menus can be found in section 4.1., "Local Terminal Management" .

10.5.2. SNMP Management

The BreezeNET PRO Access Points and Four Port Station Adapters contain an embedded SNMP agent. section 4.2., "SNMP Management" .

11. WB-10 PRO WIRELESS BRIDGE

11.1. Package List

When you first open your ***BreezeNET*** WB-10 PRO, the package contains the following:

- The ***BreezeNET PRO*** WB-10 Wireless Bridge complete with two omni-directional antennas or RF connectors for use with external antennas ("D" model).
- The WB-10 PRO Quick Installation Card
- A 5v DC-power supply transformer.
- A mounting bracket for wall or ceiling installations.

Open the packaging carefully and make sure that none of the items listed above are missing. Do not discard packaging materials. In case of return, the unit must be shipped in its original package.

11.2. Technical Specifications

See the table in section 6., "Technical Specifications" for the technical specifications of all products in the ***BreezeNET PRO Series***.

11.3. Quick Installation

Quick Installation is for experienced installers and network administrators (see Appendix A for the Quick Start Installation Guide). All others should continue on to the next section, "Installation".

11.4. Installation

This section describes how to install the ***BreezeNET WB-10 PRO*** Wireless Bridge and provides an explanation of how the Wireless Bridge automatically establishes connectivity with the wireless LAN via an Access Point (section 3.8., "Outdoor Installation Considerations").

For information on antennas and cables, section 14., "Antennas and Cables".

11.4.1. Installing the WB-10 PRO Wireless Bridge

The ***BreezeNET WB-10 PRO*** Wireless Bridge is a plug-and-play installation. All you need to get up and running is to connect it to the power supply and to connect the WB-10 PRO directly to the hub or to any available outlet of the Ethernet LAN.

You can make sure the Wireless Bridge is fully operational by checking the LED indicators as displayed in Step 4, "Check functionality using the LED indicators"on page 11-4

To complete the installation process you will need a 10 Base-T Ethernet cable with an RJ-45 connector at each end.

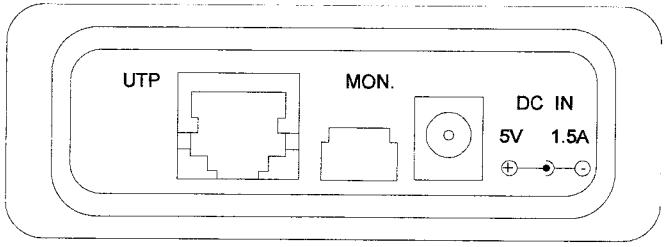


Figure 11.1: WB-10 PRO Wireless Bridge Rear Panel

Step 1
Position Your Wireless Bridge and Antennas

For best results, choose a position for your Wireless Bridge with the following points in mind:

Antennas

Make sure the antennas are extended vertically in relation to the floor, or, connect external antennas and RF cables ("D" models only).

For detailed information on selecting, installing and mounting antennas section 3.7., "Antenna Selection".

Metal Furniture

Position your Wireless Bridge well clear of metallic furniture and far from moving objects such as metallic fans or metallic doors.

Microwave Ovens

Make sure that your Wireless Bridge is well clear of radiation sources that emit in the 2.4 GHz frequency band, such as microwave ovens.

Heat Sources

Keep your Wireless Bridge clear of heat sources such as radiators or ventilation outlets.

Step 2
Connect the Wireless Bridge to the power supply.

The unit operates on a power input of 5v DC, (1200mA). This is supplied by the power transformer included with the unit.

- Connect the power transformer to an external power outlet - 110/220v AC.
- Plug the output jack of the power transformer into the DC input socket on the rear panel of the Wireless Bridge.

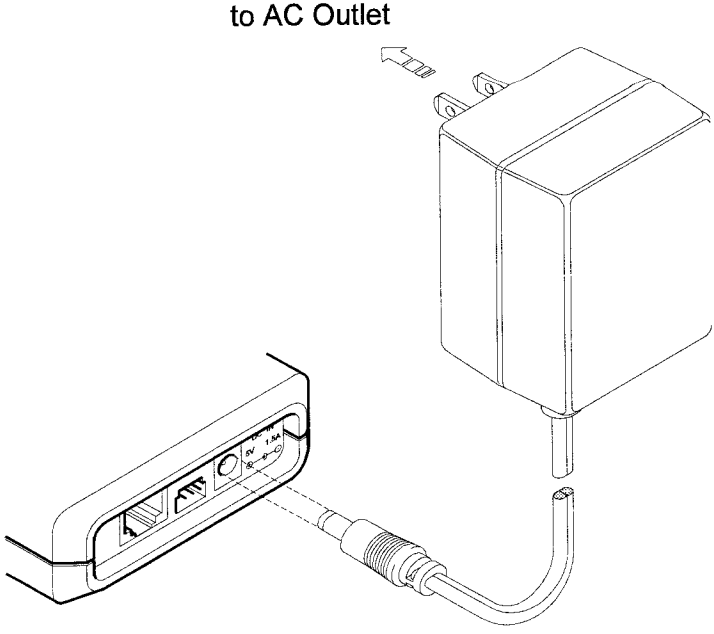


Figure 11.2: Connecting to the Power Supply

Step 3

Connect the Wireless Bridge to the hub or to any available outlet of the Ethernet LAN.

- Connect the RJ-45 connector at one end of a regular (uncrossed) Ethernet cable, to the UTP port on the rear panel of the Wireless Bridge.
- Connect the RJ-45 connector on the other end of the Ethernet cable to the Ethernet hub or to any available Ethernet outlet.

Note: When connecting the WB-10 PRO directly to a workstation (not to the hub) use a cross-over UTP cable.

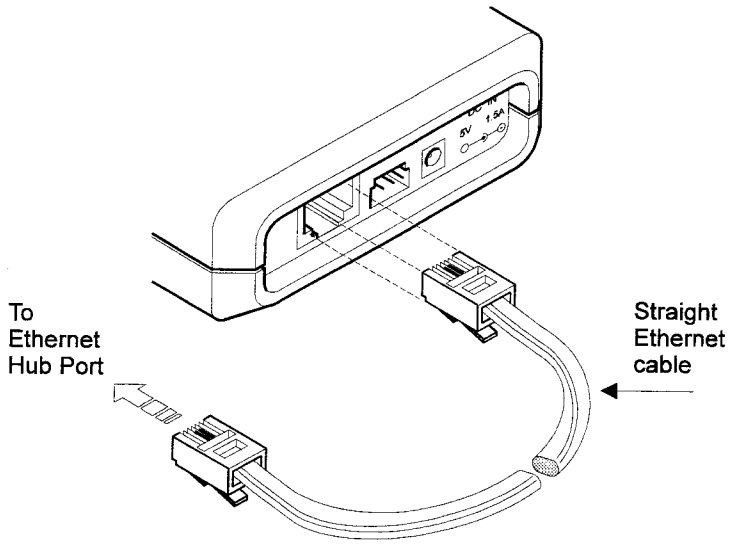


Figure 11.3:: Connecting the Wireless Bridge to an Ethernet Hub or Outlet

Step 4
Check functionality using the LED indicators.

The following aspects of Wireless Bridge functionality are checked using the LEDs on the front panel.

- Power supply
- Wireless LAN link established by synchronization with an Access Point
- Ethernet activity detected

- Reception quality.

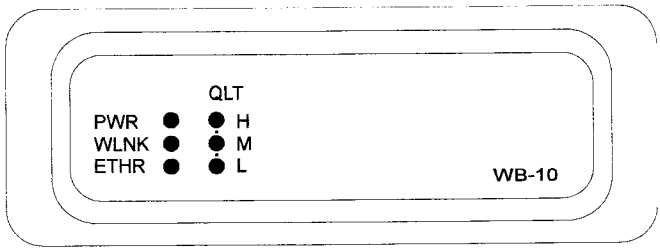


Figure 11.4:WB-10 PRO Front Panel LED Indicators

11.4.1.1. Front Panel LED Indicators

1. **PWR** (Power supply)
   Off-During power off
   On-After successful power on

2. **WLNK**
   Off-Scanning for AP
   On-Synchronized and associated with AP

3. **ETHR**
   Off-No activity on the Ethernet port
   Blinks-Activity on the Ethernet port

4. **QLT**(L,M,H))

Very low quality reception

Low quality reception

Medium quality reception

High quality reception

Note: The QLT LEDs will not light if the Wireless Bridge is not synchronized with an Access Point.

11.4.2. Associating with an Access Point

After installation of the WB-10 PRO and its antennas, your ***BreezeNET PRO*** Wireless Bridge automatically begins scanning for the remote Access Point. When the Access Point is located, the Wireless Bridge synchronizes itself to the frequencies being used, and establishes association with the Access Point.

Once association is established the Access Point starts forwarding data packets to all PCs connected through the WB-10 Wireless Bridge. Once association is established you can communicate with all the other wireless stations in the cell and, via the Access Point's Ethernet connection, with all the network facilities.

Note: The WB-10 is able to associate with the AP only if their ESSIDs are identical.

11.5. Management

The ***BreezeNET PRO*** product line has been designed as a plug and play solution, and operates without any user intervention. However, users

wishing to change some of the default parameters can do so to get additional functionality. There are two ways to set the parameters and/or the monitoring status of the station:

- Using a local monitor.
- Using an SNMP Management Information Base.

11.5.1. Local Terminal Management

Procedures for configuring ***BreezeNET WB-10 PRO*** Wireless Bridge setup and configuration menus can be found in section 4.1., "Local Terminal Management".

11.5.2. SNMP Management

The BreezeNET PRO Access Points, Station Adapters and Wireless Bridges contain an embedded SNMP agent. Refer to section 4.2., "SNMP Management".

12. AP-10DE EXTENDED RANGE ACCESS POINT

12.1. Package List

When you first open the AP-10DE , the package contains the following components:

- The ***BreezeNET*** AP-10DE Access Point, complete with two RF connectors for use with external antennas.
- This ***BreezeNET PRO Series*** System Administrator Guide.
- AP-10 PRO/AP-10DE Quick Installation Guide
- 5V DC power supply transformer.
- A monitor connector cable.
  (For connecting the Access Point to a monitor in order to perform Local Terminal Management functions. (See section 4.1.)
- Proprietary MIB disk for performing remote unit configuration and monitoring (section 4.2., "SNMP Management").
- Mounting bracket for wall or ceiling installations.

Open the packaging carefully and make sure that none of the items listed above are missing. Do not discard packaging materials. If, for any reason, the unit is returned, it must be shipped in its original package.

Note: The WB-10DE and AP-10DE are not compatible with the BreezeNET PRO Series. The SA-10 PRO, SA-PC PRO, SA-40 PRO, and WB-10 PRO units cannot communicate with the AP-10DE or the WB-10DE.

12.2. Technical Specifications

See the table in Section 6, "Technical Specifications" for the technical specifications of all products in the ***BreezeNET PRO Series***.

12.3. Quick Installation

Quick Installation is for experienced installers and network administrators (see Appendix A for the Quick Installation Guide). All others should

continue on to the next section, "Installing the AP-10DE".

12.4. Installing the AP-10DE

Use the following steps to install the ***BreezeNET*** Extended Range Access Point:

- Choose the best location to place the Access Point.
- Connect the RF cable and antennas.
- Connect to the power supply.
- Connect to the Ethernet backbone.
- Check functionality using the LED indicators.

Step 1
Position the Access Point

BreezeNET PRO wireless LAN products are robust, trouble-free units, designed to operate efficiently under a wide range of conditions. The following guidelines are provided to help you position the Access Points to ensure optimum coverage and operation of the ***BreezeNET PRO*** LAN.

Height

Install the Access Point at least 1.5m above the floor, clear of any high office partitions or tall pieces of furniture in the coverage area. The Access Point can be placed on a high shelf, or can be attached to the ceiling or a wall using a mounting bracket.

Antennas

Make sure the unit is connected to the external antennas and RF cable.

Central Location

Install the Access Point in a central location in the intended coverage area. Good positions are:

- In the center of a large room.
- In the center of a corridor.
- At the intersection of two corridors.

Many modern buildings have partitions constructed of metal or containing metal components. We recommend that you install the Access Points on the corridor ceilings. The radio waves propagated by the ***BreezeNET PRO*** LAN are reflected along the metal partitions and enter the offices through the doors or glass sections.

Metal Furniture

Position the Access Points clear of metal furniture and away from moving objects such as metal fans or doors.

Heat Sources

Keep the Access Point well away from sources of heat, such as radiators, air-conditioners, etc.

Microwave Ovens

Position the Access Points clear of radiation sources that emit in the 2.4 GHz frequency band, such as microwave ovens.

Step 2
Connect the Access Point to the Power Supply

The unit operates on a power input of 5V DC, (1200mA). This is supplied by the power transformer included with the unit.

- Plug the output jack of the power transformer into the DC input socket on the rear panel of the AP-10DE Access Point.
- Connect the supplied power transformer to an external power supply - 110/220VAC.

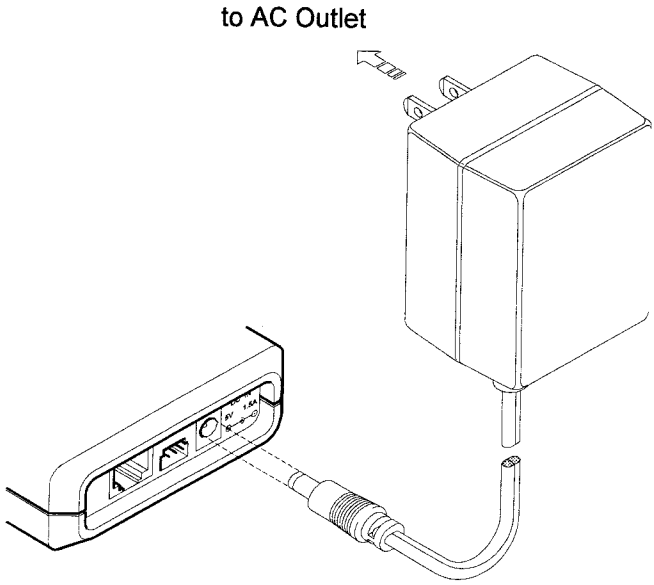


Figure 12.1: Connecting to the Power Supply

Step 3
Connect the Access Point to the Ethernet Backbone

Attach one end of a straight Ethernet 10BaseT cable (not supplied) to the RJ-45 port on the rear panel of the Access Point (marked UTP).

Attach the other end of the connector cable to any available Ethernet outlet. When connecting the AP directly to a network interface card of a server or workstation, use a cross-over 10Base-T cable.

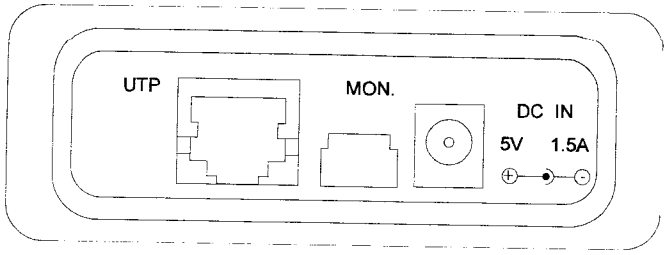


Figure 7.2: AP-10DE Access Point Rear Panel

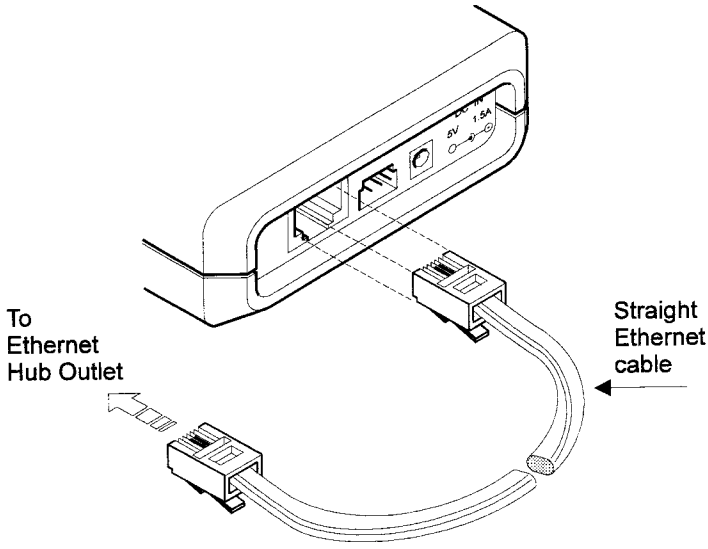


Figure 7.3:Connecting the Access Point to the Ethernet Backbone

Step 4
Check Access Point Functionality using LED indicators

Check the following Access Point functions by using the LEDs on the front panel.

- Power supply
- Radio interference
- Ethernet activity
- LAN load

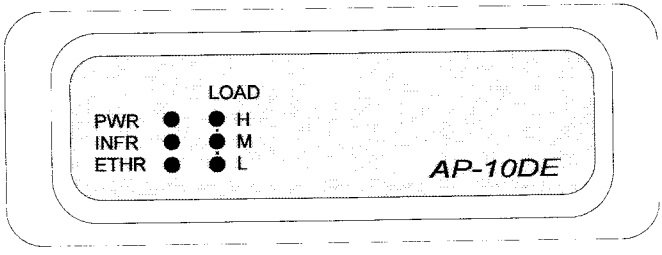


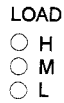
Figure 7.4: AP-10DE Front Panel LED indicators

PWR (Power supply; Power on test)
Off -During power off
On -After successful power on

INFR (Radio interference)
Off -No interference
Blinks -Interference present

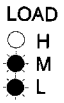
ETHR (Ethernet activity)
Off -No activity on the Ethernet Port
Blinks -Activity on the Ethernet Port

LOAD (L,M,H) (No. of associated stations)



No stations

1-4 stations



5-8 stations

9 or more stations

12.4.1. Verifying the Ethernet Connection

Once the Access Point is connected to an Ethernet outlet, the ETHR LED on the front panel blinks when it senses LAN traffic, thus verifying the Ethernet connection. Verify that the LINK indicator on the attached hub port is ON.

12.5. Management

The ***BreezeNET*** AP-10DE has been designed as a plug and play solution, and

operates without any user intervention. However, users wishing to change some of the default parameters can do so to get additional functionality. There are two ways to set the parameters and/or the monitoring status of the station:

- Using a local monitor.
- Using an SNMP Management Information Base.

12.5.1. Local Terminal Management

Procedures for accessing and configuring ***BreezeNET AP-10DE*** Access Point setup and configuration menus can be found in section 4.1., "Local Terminal Management".

12.5.2. SNMP Management

The ***BreezeNET*** Extended Range Access Points and Station Adapters contain an embedded SNMP agent. Refer to section 4.2., "SNMP Management".

13. WB-10DE EXTENDED RANGE BRIDGE

13.1. Package List

When you first open your ***BreezeNET*** WB-10 DE, the package contains the following:

- The ***BreezeNET*** WB-10DE Extended Range Wireless Bridge complete with RF connectors for use with external antennas ("D" model).
- The WB-10 PRO/ WB-10DE Quick Installation Card
- A 5v DC-power supply transformer.
- Mounting bracket for wall or ceiling installations.

Open the packaging carefully and make sure that none of the items listed above are missing. Do not discard packaging materials. In case of return, the unit must be shipped in its original package.

13.2. Technical Specifications

See the table in Section 6, "Technical Specifications" for the technical specifications of all products in the ***BreezeNET PRO Series***.

13.3. Quick Installation

Quick Installation is for experienced installers and network administrators (see Appendix A for the Quick Start Installation Guide). All others should continue on to the next section, "Installation".

13.4. Installation

This section describes how to install the ***BreezeNET*** WB-10DE Extended Range Bridge and provides an explanation of how it automatically establishes connectivity with the remote Ethernet network via an AP-10DE Extended Range Access Point.

For information on antennas and cables, see section 14., "Antennas and Cables".

13.4.1. Installing the WB-10 DE Extended Range Bridge Adapter

The ***BreezeNET*** WB-10DE Wireless Bridge implements plug-and-play installation. All you need to get up and running is to connect the Wireless Bridge to the power supply and to your computer.

You can verify that the Wireless Bridge is fully operational by checking the LED indicators as described in section 13.4.1.1., "Front Panel LED Indicators".

To complete the installation process you need a 10Base-T Ethernet connector cable with RJ-45 connector at each end.

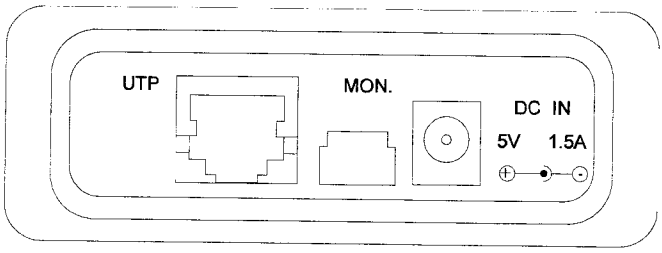


Figure 13.1: WB-10DE Wireless Bridge rear panel

Step 1
Position Your Wireless Bridge and Antennas

The best results will be obtained if you choose a position for your Wireless Bridge, bearing the following points in mind:

Antennas

Connect external antennas and RF cables.

For detailed information on selecting, installing and mounting antennas see section 3.7, Antenna Selection.

Metal Furniture

Position your Wireless Bridge well clear of metallic furniture and far from moving objects such as metallic fans or metallic doors.

Microwave Ovens

Make sure that your Wireless Bridge is well clear of radiation sources that emit in the 2.4 GHz frequency band, such as microwave ovens.

Heat Sources

Keep your Wireless Bridge clear of heat sources such as radiators or ventilation outlets.

Step 2
Connect the Wireless Bridge to the power supply.

The unit operates on a power input of 5v DC, (1200mA). This is supplied by the power transformer included with the unit.

- Connect the power transformer to an external power outlet - 110/220v AC.
- Plug the output jack of the power transformer into the DC input socket on the rear panel of the Wireless Bridge

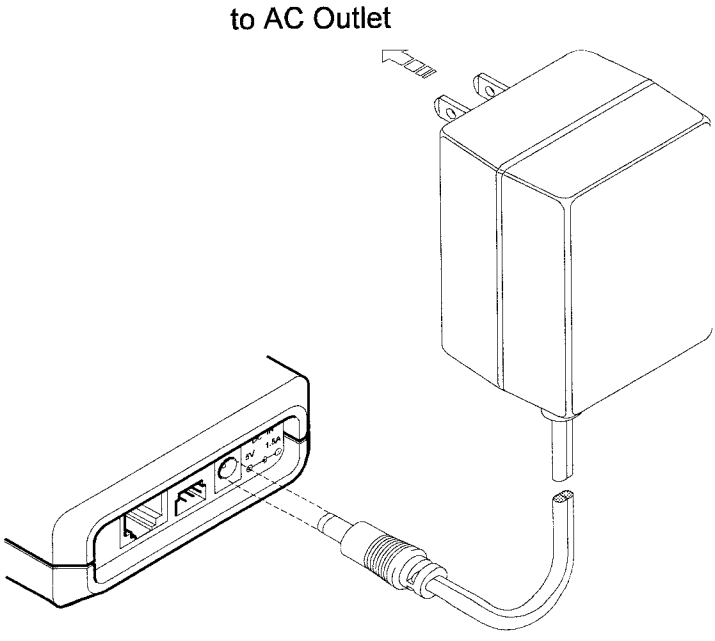


Figure 13.2: Connecting to the Power Supply

Step 3
Connect the Wireless Bridge to the hub or to any available outlet of the Ethernet LAN.

- Connect the RJ-45 connector at one end of a regular (uncrossed) Ethernet cable, to the UTP port on the rear panel of the Wireless Bridge.

- Connect the RJ-45 connector on the other end of the Ethernet cable to the Ethernet hub or to any available Ethernet outlet.

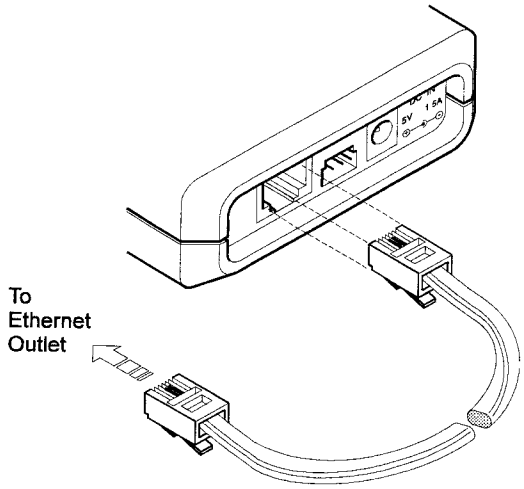


Figure 13.3: : Connecting the Wireless Bridge to an Ethernet Hub or Outlet

Step 4
Check functionality using the LED indicators.

Use the LEDs on the front panel to check the following aspects of Wireless Bridge functionality.

- Power supply

- Wireless LAN link established by synchronization with an Access Point

- Ethernet activity detected

- Reception quality.

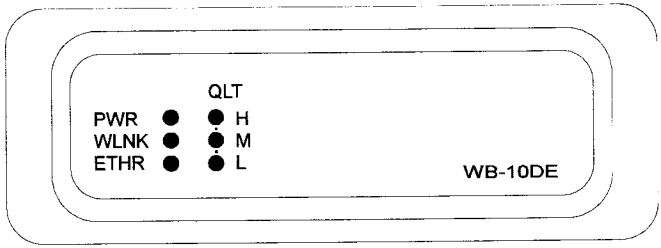


Figure 13.4: WB-10DE Front Panel Indicators

13.4.1.1. Front Panel LED Indicators

PWR (Power supply; Power on test)

Off -During power off

On -After successful power on

WLNK

Off -Scanning for AP

On -Synchronized and associated with AP

ETHR

Off -No activity on the Ethernet port

Blinks -Activity on the Ethernet port

QLT(L,M,H)

Very low quality reception

Low quality reception

Medium quality reception

High quality reception

Note:: The QLT LEDs will not light if the Wireless Bridge is not synchronized with an Access Point.

13.4.2. Associating with an Access Point

After installation of the WB-10DE and its antennas, your ***BreezeNET*** Wireless Bridge automatically begins scanning for the remote Access Point. When the Access Point is located, the Wireless Bridge synchronizes itself to the frequencies being used, and establishes association with the Access Point.

When the PC begins sending out Ethernet packets through the WB, the AP learns the PC's source address from the first packet. In this way the PC is associated with the AP. From this moment on, the AP forwards frames intended for the associated PC from the Ethernet LAN through the WB.

Once association is established, the Access Point starts forwarding data packets to all PCs connected through the WB-10 Wireless Bridge. Once association is established you can communicate with all the other wireless stations in the cell and, via the Access Point's Ethernet connection, with all the network facilities.

13.5. Management

The ***BreezeNET PRO*** product line has been designed as a plug and play solution, and operates without any user intervention. However, users wishing to change some of the default parameters can do so to get additional functionality. There are two ways to set the parameters and/or the monitoring status of the station:

- Using a local monitor.
- Using an SNMP Management Information Base.

13.5.1. Local Terminal Management

Procedures for configuring ***BreezeNET WB-10 DE*** Wireless Bridge setup and configuration menus can be found in section 4.1., "Local Terminal Management".

13.5.2. SNMP Management

The BreezeNET WB-10DE Wireless Bridge contains an embedded SNMP agent. Refer to section 4.2., "SNMP Management".

D Antennas and Accessories

14. ANTENNAS AND CABLES

14.1. Introduction

All products in the ***BreezeNET PRO Series*** (except for the PC Card) are available in two models, standard and "D". The models are identical in all respects except for their antennas. The standard model is equipped with two built-in 2 dBi omni-directional antennas and is suitable for indoor, short-to-medium range installations.

The "D" model is equipped with two customized female connectors for use with the following range of external antennas:

- 6 dBi omni-directional transmit/receive antenna (USA and Europe)
- 7.2 dBi omni-directional transmit/receive antenna (USA only)
- 8.5 dBi uni-directional transmit/receive antenna (USA and Europe)
- 12 dBi uni-directional transmit/receive antenna (USA only)
- 18 dBi uni-directional transmit/receive antenna (USA and Europe)
- 24 dBi uni-directional transmit/receive antenna (USA only)

These antennas are divided into two groups, low gain and high gain transmit/receive antennas. The 6 dBi, and 8.5 dBi antennas are low gain antennas suitable for all indoor applications (wall and window installations) as well as short-to-medium range outdoor ground-level applications where antenna diversity is required. The 7.2 dBi antenna is for use mainly in outdoor applications where point-to-multipoint configuration is required. The larger 18 and 24 dBi models are used for rooftop installations.

All antennas are supplied with cables suitable for installation both in Europe and in the USA. The length of cable supplied is sufficient for basic installation.

The following table provides specifications for all available antennas:

Antenna	Omni-6	Omni-7.2	Uni-8.5	Uni-12	Uni-18	Uni-24
Beamwidth	360°	360°	75°	22°	14°	7.5°
Cable Length (ft.)	4	20	8	20	30	50
Assembly net gain	5	6	6.5	10	15	19
Size	13x Ø1"	16 x Ø1"	4x3.75x1.25"	12x12x15"	16x20x15"	24x36x15"

Caution

Detached antennas, whether installed indoors or out, should be installed ONLY by experienced antenna installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities.
Failure to do so may void the BreezeNET Product Warranty and may expose the end user to legal and financial liabilities. BreezeCOM and its resellers or distributors are not liable for injury, damage or violation of government regulations associated with the installation of detached antennas.

14.2. Summary of Antenna Characteristics

Antenna Features	6 dBi	8.5 dBi	12 dBi	18 dBi	24dBi
Gain level	low	medium	medium	high	high
Beam Width	omni	wide	medium	narrow	very narrow
Required alignment accuracy	none	low	medium	high	high
Multipath sensitivity	high	high	medium	low	low
Antenna size	small	small	small	medium	large

14.3. Product Description

14.3.1. Products Available in the USA

Low-Gain Transmit/Receive Antenna Sets

Omni-6

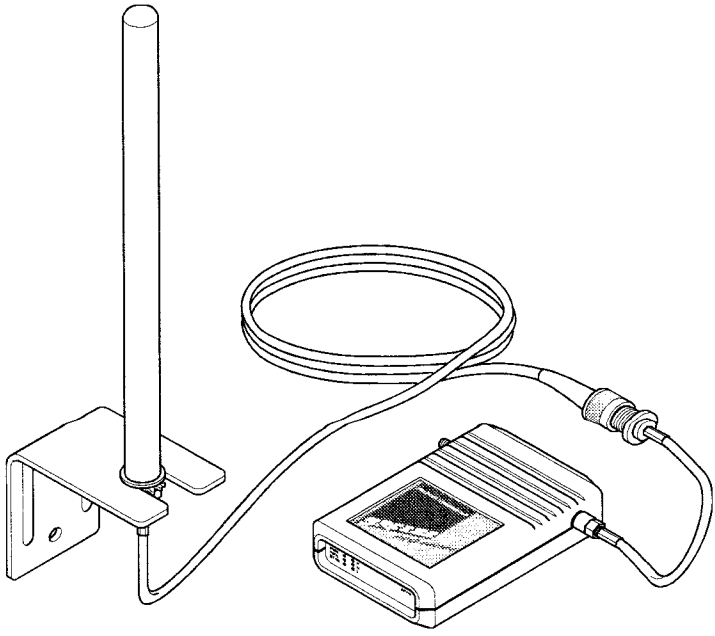


Figure 14.1: The Omni-6 Antenna

The Omni-6 6 dBi antenna is used for indoor WLAN networking installation when an extended coverage area is required.

The set includes:

- 1 Omni-directional 6 dBi transmit/receive antenna
- 4 ft. cable complete with assembled sections and connectors:

Omni-7.2

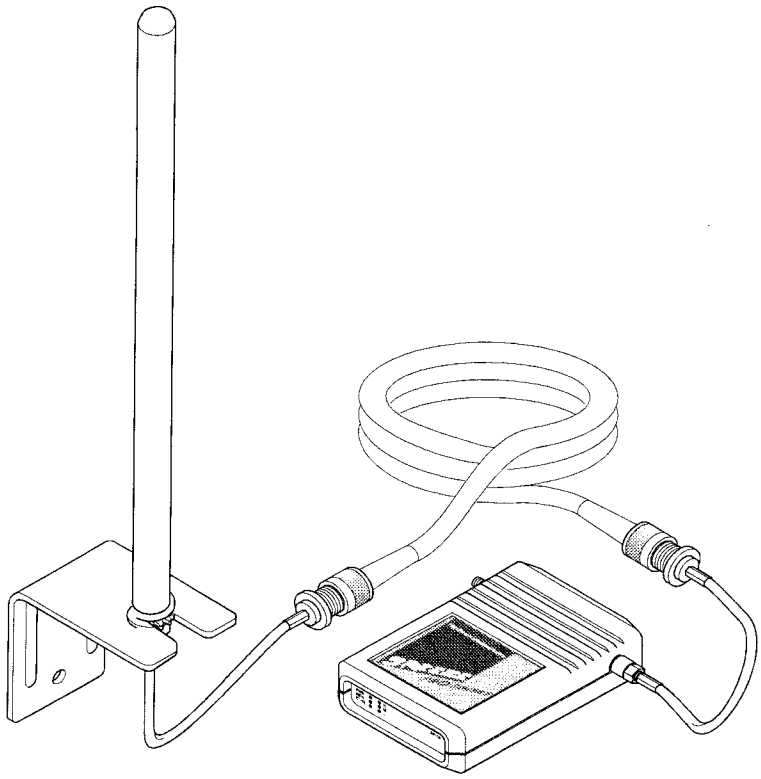


Figure 14.2: The Omni-7.2 Antenna

The Omni-7.2 dBi antenna is used for indoor or outdoor point-to-multipoint installation when there are longer distances between sites than those covered by the standard, built-in antennas.

The set includes:

- 1 Omni-directional 7.2 dBi transmit/receive antenna
- 20 ft. cable complete with assembled sections and connectors.

Uni-8.5

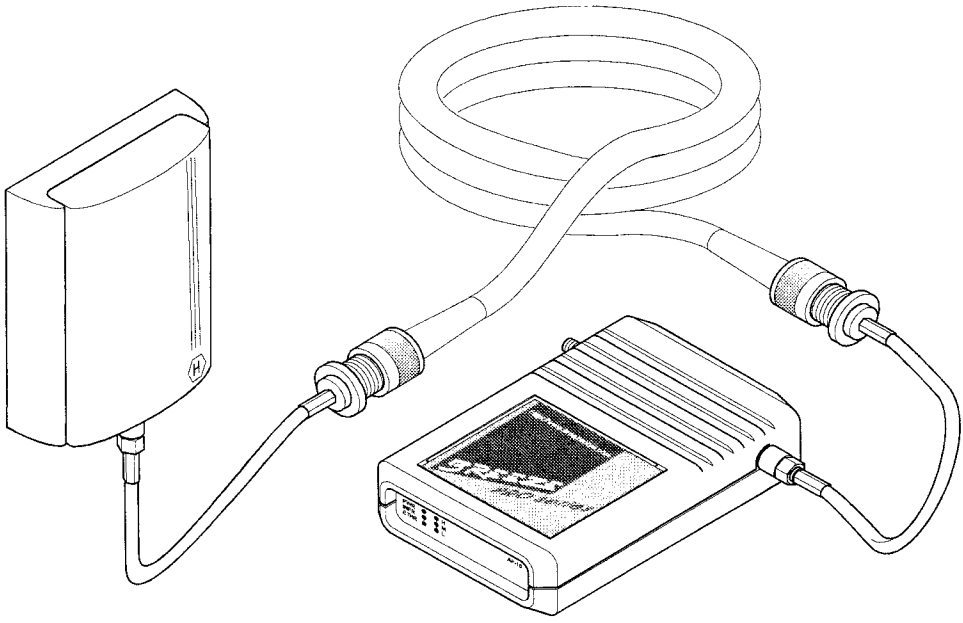


Figure 14.3: The Uni-8.5 Antenna

The Uni 8.5 is used for both indoor and outdoor short-to-medium range installations. The antenna has a wide beam width (75 degrees horizontal, 50 degrees vertical).

The set includes:

- 8.5 dBi uni-directional transmit/receive antenna.
- 8 ft. cable complete with assembled connectors.

Extention Cables

The cables supplied in the antenna sets are usually sufficient for most window and wall installations. Extention cables are available in the following lengths:

10, 20, 30, and 50 ft.

High Gain Transmit/Receive Antennas

Uni-12

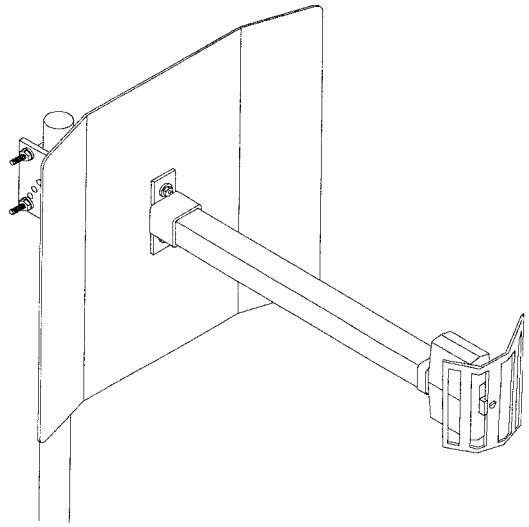


Figure 14.4: The Uni-12 Antenna

The Uni-12 12 dBi antenna has a medium beam width of 22 degrees and is used for outdoor, medium-distance installations.

The set contains:

- One uni-directional 12 dBi transmit/receive antenna
- 20 ft. cable complete with assembled connectors:

Uni-18

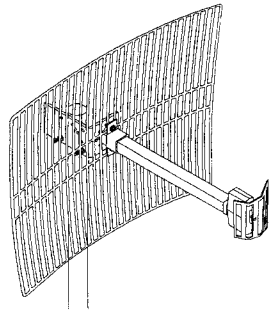


Figure 14.5: The Uni-18 Antenna on Mast

An 18 dBi antenna with a narrow beamwidth (14 degrees). This beamwidth increases sensitivity to inaccurate alignment and decreases the influence of multipath propagation (fading). It is the best choice for most outdoor, medium-to-long distance rooftop installations.

The set contains:

- One uni-directional 18 dBi transmit/receive antenna
- 30 ft. cable complete with assembled sections and connectors:

Uni-24

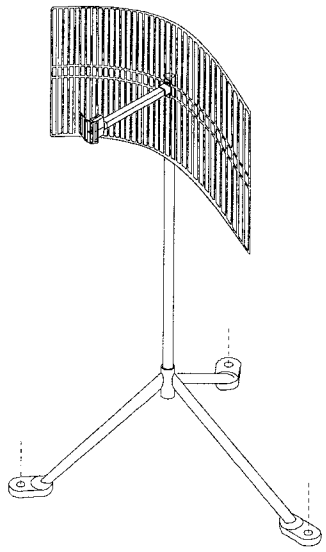


Figure 14.6: Uni-24 Antenna on Mast

A 24 dBi antenna with narrow beam width (7.5 degrees). This beam width increases sensitivity to alignment inaccuracies and decreases the influence of multipath propagation (fading). It is used for outdoor installations over large distances and is supplied with long cables for higher rooftop installation.

The set contains:

- One uni-directional 24 dBi transmit/receive antenna
- 50 ft. cable complete with assembled sections and connectors:

Extention Cables

Extention cables are available in lengths of:

10, 20, 30 and 50 ft.

14.3.2. Products Available in Europe

Low-Gain Transmit/Receive Antenna Sets

Omni-6

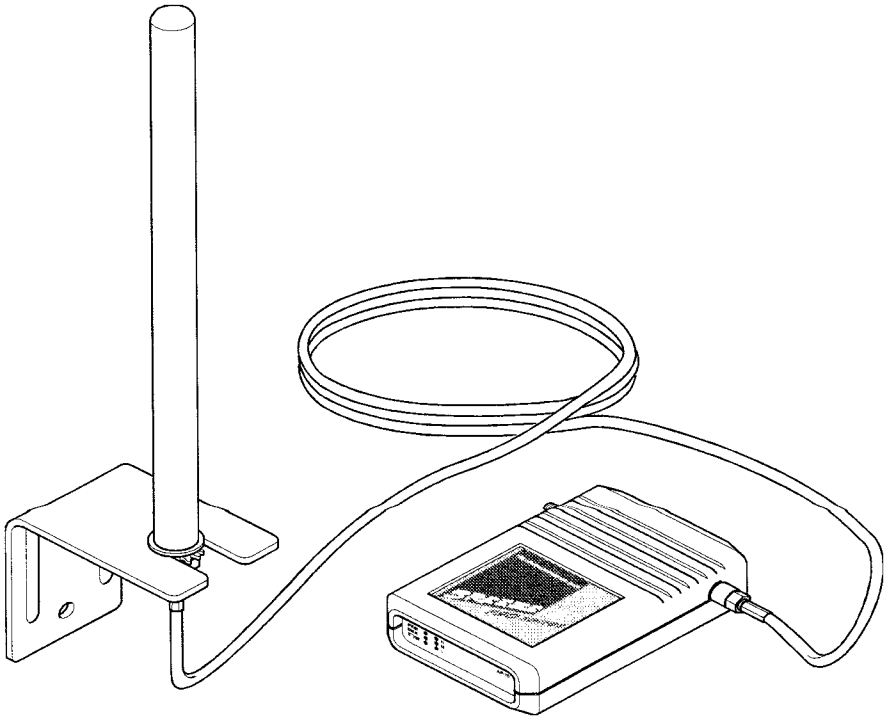


Figure 14.7: The Omni-6 Antenna

The Omni-6 6 dBi antenna is used for indoor or outdoor point-to-multipoint installation when there are longer distances between sites than those covered by the standard, built-in antennas.

The set includes:

- 2 Omni-directional 6 dBi transmit/receive antennas
- 2 x 3 m RG-58 cable complete with assembled sections and connectors:
  - - SMA male connector to connect to the BreezeNET PRO unit.

- - N-type male connector to connect to the antenna.

Uni-8.5

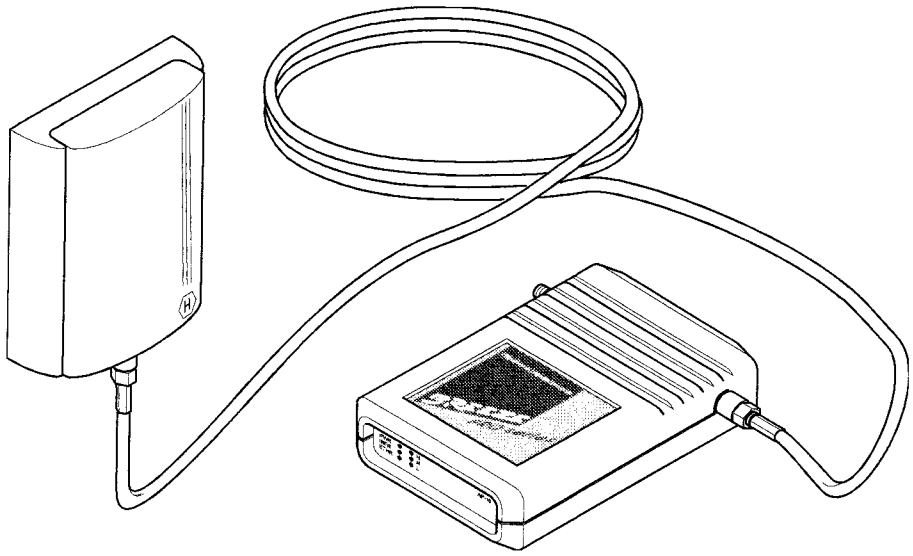


Figure 14.8: The Uni-8.5 Antenna

The Uni 8.5 is used for both indoor and outdoor short-to-medium range installations. The antenna has a wide beam width (75 degrees horizontal, 50 degrees vertical).

The set includes:

- Two 8.5 dBi uni-directional transmit/receive antennas
- 2 x 6 m RG-58 cable complete with assembled connectors:
  - - SMA male connector to connect to the BreezeNET PRO unit.
  - - N-type male connector to connect to the antenna.

Extention Cables

The cables supplied in the antenna sets are usually sufficient for most window and wall installations. Extention cables are available in the following lengths:

5,10, 15 and 20 meters (16, 32, 48 and 65 ft).

High Gain Transmit/Receive Antennas

Uni-18

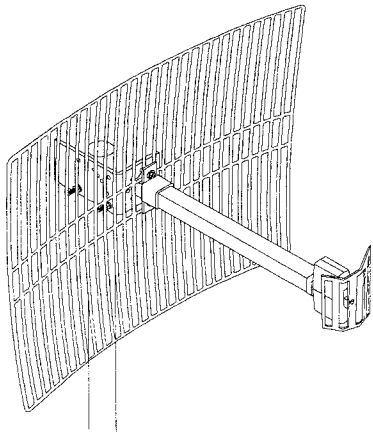


Figure 14.9: The Uni-18 Antenna on Mast

An 18 dBi antenna with a narrow beamwidth (14 degrees). This beamwidth increases sensitivity to inaccurate alignment and decreases the influence of multipath propagation (fading). It is the best choice for most outdoor, medium-to-long distance rooftop installations.

The set contains:

- One uni-directional 18 dBi transmit/receive antenna
- 10, 15 or 20 m (32.5, 48 or 65 ft.)"Heliax" cable complete with assembled sections and connectors:
    - - SMA male connector to connect to the BreezeNET PRO unit.
    - - N-type male connector to connect to the antenna.

Extention Cables

Extention cables are available in lengths of:

5,10, 15 and 20 meters (16, 32, 48 and 65 ft).

14.4. Installation Restrictions and Guidelines

14.4.1. Professional Installers Only

Caution
Detached antennas, whether installed indoors or out, should be installed ONLY by experienced antenna installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities. Failure to do so may void the BreezeNET Product Warranty and may expose the end user to legal and financial liabilities. BreezeCOM and its resellers or distributors are not liable for injury, damage or violation of government regulations associated with the installation of detached antennas.

14.4.2. Transmit Antenna Gain

Regulations regarding maximum antenna gains vary from country to country. It is the responsibility of the end user to operate within the limits of these regulations and to ensure that the professional installer is aware of these regulations, as well. The FCC in the United States and ETSI in Europe limit effective transit power to 36dBm (USA) and 20dBm (Europe). The maximum total assembly gain of antennas and cables in this case equals 19dBi (USA) and 3dBi (Europe).

Violation of government regulations exposes the end user to legal and financial liabilities. BreezeCOM, its resellers and distributors shall not be liable for expense or damage incurred as a result of installations which exceed local transmit gain limitations.

14.4.3. Spurious Radio Frequency Emissions

The regulations referred to in the previous section also specify maximum "out-of-band" radio frequency emissions. Install a filter as close as possible to the BreezeNET PRO "D" model unit connector. BreezeCOM offers the following in-line filter assembly:

BreezeNET™ Part no. 872909 In-Line Filter Cable Assembly, "N" Female to "N" Male.

14.4.4. Lightning Protection

Lightning Protection is designed to protect people, property and equipment by providing a path to ground for the lightning's energy. The lightning arrestor diverts

the strike energy to ground through a deliberate and controlled path instead of allowing it to choose a random path. Lightning protection for a building is more forgiving than protection of electronic devices. A building can withstand up to 100,000 volts, but electronic equipment may be damaged by just a few volts.

Lightning protection entails connecting an antenna discharge unit (also called an arrestor) to each cable as close as possible to the point where it enters the building. It also entails proper grounding of the arrestors and of the antenna mast (if the antenna is connected to one).

The lightning arrestor should be installed and grounded at the point where the cable enters the building. The arrestor is connected to the unit at one end and to the antenna at the other end.

The professional installer you choose must be knowledgeable about lightning protection. The installer must install the lightning protector in a way that maximizes lightning protection. BreezeCOM offers the following high-quality lightning arrestor assembly:

BreezeNET™ AL 1 Lightning Arrestor - Part No. 872905 5 ft (1.5m), "N" Male to "N" Female.

14.5. Rooftop Installation

WARNING!!!
Rooftop antenna installation are extremely dangerous! Incorrect installation may result in death, serious injury and/or damage. Such installations should be performed by professional antenna installers only!

Rooftop installations offer several advantages:

- Increased antenna range
- Less obstacles in path
- Improved performance due to greater height
- Reduced multipath problems

For a more detailed explanation of rooftop installations, see section 3.8., "Outdoor Installation Considerations".

15. ACCESSORIES

15.1. TPA 24 Transmit Power Amplifier

The TPA 24 transmit power amplifier is used to amplify the transmit power to a fixed output of 24 dBm (250 mW). The TPA 24 is especially useful when long RF cable runs are required. In addition, the TPA 24 simplifies antenna alignment by enabling the use of wider dispersion transmit antennas (12 dBi maximum).

The TPA 24 NL receives input power in the range of -10dBm to 0dBm. The TPA 24 NH receives an input power of 0dBm to +10dBm . Both models then amplify the input power to a fixed output level of 24dBm (250mW).

In compliance with FCC regulations in the United States, the TPA 24 can be connected to an antenna with a maximum gain of 12dBi , resulting in a total EIRP transmitted power or 36 dBm (4W).

When used in compliance with ETSI regulations, the TPA 24 can be connected to cables and antennas resulting in a total transmitted power of 20dBm (100 mW) EIRP.

15.1.1. Technical Specifications

Models used with the BreezeNET PRO Series:	• TPA 24 NL • TPA 24 NH. •
Input Power:	• TPA 24 NL: -10dBm - 0dBm (Low input) • TPA 24 NH: 0dBm - +10dBm (High input)
Output Power:	24 dBm (250mW) (fixed output level)
Input Impedance:	50Ω
Output Impedance:	50Ω
Operating Temperature:	-20° to 50°C

Power Requirements:	12V; 420 mA (PS and Power Inserter are supplied with models TPA-24 NL and TPA-24 NH
Connectors:	• TPA 24: IN - N-type Male OUT - N-type Female • Power Inserter: RF - N-type Male RF&DC - N-type Female
Dimensions:	70mm x 150mm x 25mm (2.8"x 6"x 1")
Operating Environment:	• TPA 24 - For outdoor/indoor use • Power Supply - For indoor use • Power Inserter - For indoor use

15.1.2. Installing the TPA 24

The RF cable carries 12Vdc from the power inserter to the TPA 24. Before installing the TPA 24, the following steps must be taken:

1. Use both antennas.

2. Configure the ***BreezeNET PRO*** unit via the Monitor to transmit through Antenna 2 only (see section 4.1.1.3.4., "Transmit Diversity"). This forces transmission through the TPA 24 and through the antenna attached to the selected connector.

3. Install the TPA 24 on the antenna attached to the Antenna 2 connector to increase transmitted signal power.

⇒ ***To install the TPA 24:***

1. Connect the TPA 24 RF output directly to the output of the antenna.

2. Attach the TPA 24 RF input to the Power Inserter with the RF cable.

3. Connect the RF cable leading from the Power Inserter to the Antenna 2 connector on the ***BreezeNET PRO*** unit.

4. Plug the power cable leading from the Power Inserter into any

available 110/220V outlet.

Note: *Installations exceeding regulations set by local authorities expose the installer and the user to potential legal and financial liabilities.*

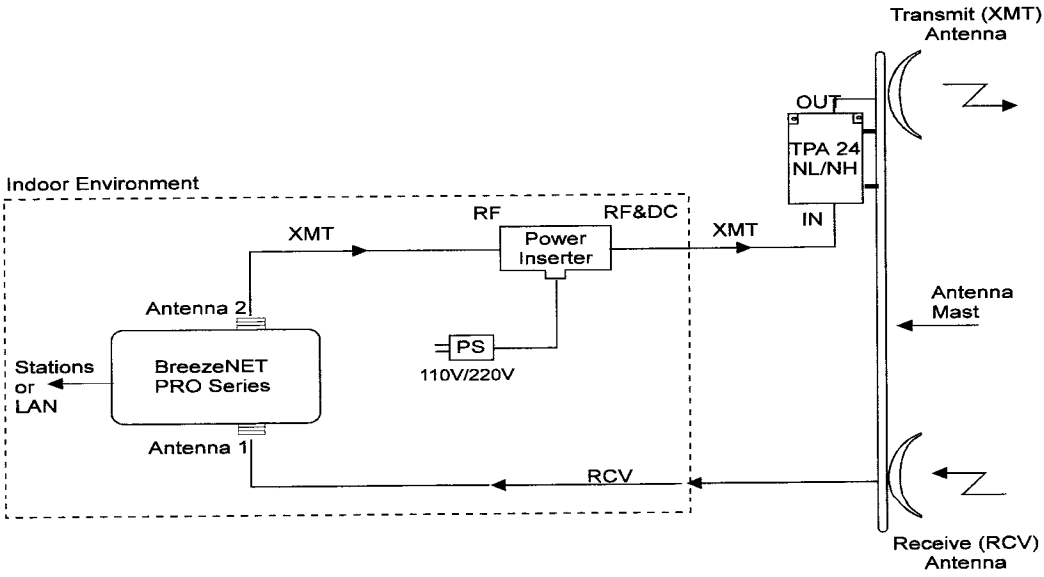


Figure 15.1: TPA 24 Installation

15.2. LNA 10 Low Noise Receive Amplifier

The LNA 10 is a high-performance, low-noise preamplifier designed to enhance fringe area reception and provide additional gain on the receive antenna when using long cable runs. Its exceptionally small size and light weight enables it to be directly mounted on the antenna by means of the female RF IN connector. Power is obtained through an RG-59 coaxial cable connected to the power supply. The LNA 10 incorporates internal lightning and voltage surge protection.

The Power Supply (PS) and Power Inserter are supplied with the LNA 10. The RG-59 coaxial cable with F-type connector is not supplied and must be purchased separately.

15.2.1. Technical Specifications*

Gain:	10dB
Noise Figure:	1.5dB Typ, 2dB Max.
Response Flatness:	± 1.5dB
Max. RF Input Level:	-15dBm
Input Impedance:	50Ω
Output Impedance:	50Ω
Connectors:	
LNA 10	• RF IN: N-type, female • RF OUT: N-type, male • Signal and Power IN: not in use • Signal and Power OUT: F-type, female
Power Inserter	• To CONV - F-type, female • To TV - F-type, female
Power Supply:	
Required Voltage:	+12V to +28Vdc
Required Current :	20mA

Operating Temperature:	-20° C to +50° C
Dimensions:	60mm x 35mm x 25mm (2.3"x 1.3"x 1")

Operating Environment:

- LNA 10: outdoor/indoor
- Power Supply: indoor
- Power Inserter: indoor

* Note: Technical specifications are listed as provided by the manufacturer.

15.2.2. Installing the LNA 10

Before installing the LNA 10, the following steps must be taken:

1. Use both antennas.

2. Configure the ***BreezeNET PRO*** unit via the Monitor to transmit through Antenna 2 only (see section 4.1.1.3.4., "Transmit Diversity"). This forces transmission through the antenna attached to the selected connector, preventing transmission through the LNA 10.

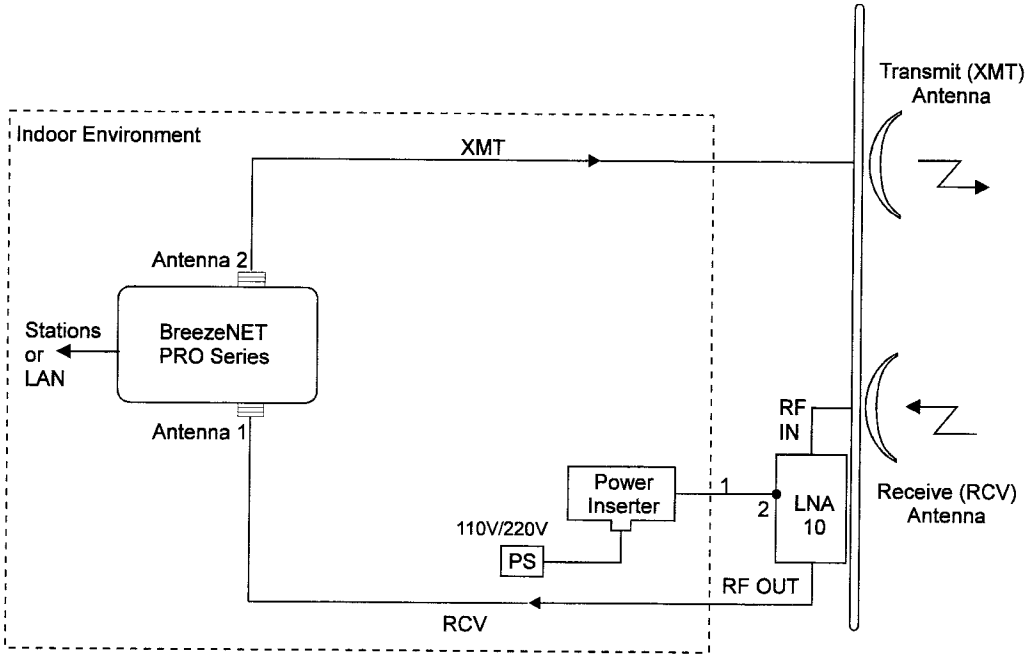
3. Install the LNA 10 on the antenna attached to the "Antenna 1" connector to increase received signal power.

⇒ ***To install the LNA 10:***

1. Attach the LNA-10 RF output directly to the RF cable going down to the selected connector on the ***BreezeNET PRO*** unit.

2. Connect the LAN-10 RF input directly to the output of the antenna.

3. Connect to the RG-59 coaxial cable which leads down to the power supply to the "Signal and Power out" connector on the LNA-10.



1 - RG-59 Coax, F-type Connector
2 - OUT (Signal and Power)

Figure 15.2: LNA-10 Connections Diagram

15.3. RFS 122 - Radio Frequency Splitter

The RFS 122 Radio Frequency Splitter is used to split the original RF signal generated by a transmitter into two signals. These signals are then sent to two different and independent antennas. The RFS 122 enables radio transmission using two directional antennas connected to the same port of the ***BreezeNET PRO*** unit.

Before installing the RFS 122, do the following:

- Configure the ***BreezeNET PRO*** unit via the Monitor to transmit through Antenna 2 only (see section 4.1.1.3.4., "Transmit Diversity" in section 4., "System Management"). This forces transmission through the antenna attached to the selected connector, forcing transmission through the RFS 122.

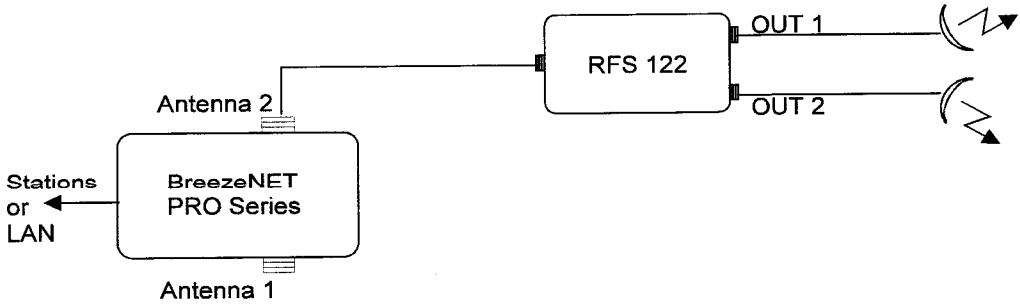


Figure 15.3: RFS-122 Connection Diagram

15.3.1. Technical Specifications*

Insertion Loss:	3.8dB max.
Isolation:	19dB min.
Power Rating:	10 W max.
Internal Load: Dissipation	125 mW max.
Input Impedance:	50Ω
Output Impedance:	50Ω
Connectors:	
• SUM	N-type, Male
• PORTS	N-type, Female (on each port)
Operating Temperature:	-20° C to +85° C
Dimensions:	51mm x 51mm x 19mm (2" x 2" x 0.75")
Operating Environment:	Outdoor/Indoor

* Note: Technical specifications are listed as provided by the manufacturer.

15.4. AL 1 Lightning Arrestor

The AL 1 Lightning Arrestor is used to protect transmitters and receivers from transients originating from lightning or EMP.

The AL 1 is gas tube-based and is not radioactive. The gas discharge tube can sustain several transients if the time period between transients is sufficient to allow the tube to cool down.

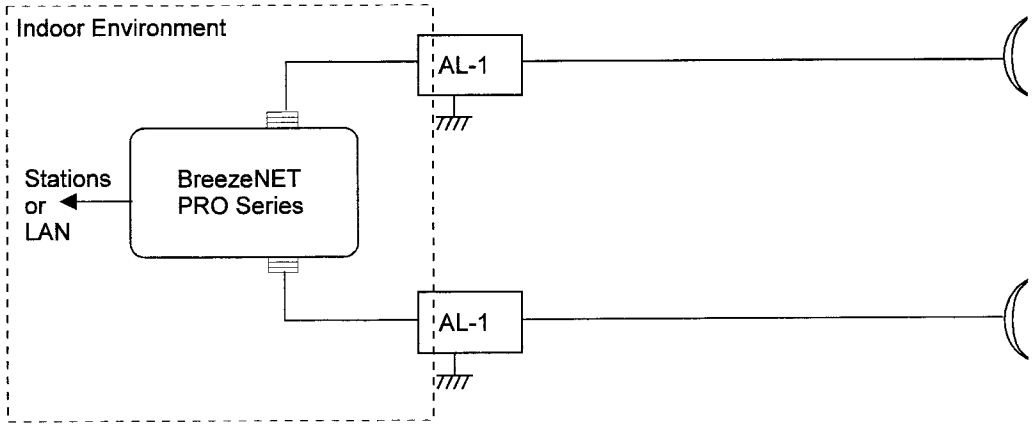


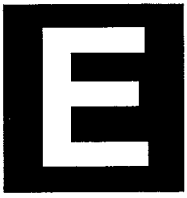
Figure 15.4: AL-1 Connection Block Diagram

15.4.1. Technical Specifications*

Turn on voltage:	75V
Insertion loss:	0.3dB typical
DC path from input to output:	existing
Operating Temperature:	-55° C to +70° C
Dimensions:	67.5mm x 25mm x 25mm (2.7" x 1" x 1")
Connectors:	
• Antenna Port	N-type, Female
• Equipment Port	N-type, Female

Operating Environment:	Indoor/Outdoor
Grounding:	One of the female-type N connectors is mounted directly through a hole in the shelter wall and held in place with a lockwasher and nut.

* Note: Technical specifications are listed as provided by the manufacturer.



Appendices

APPENDIX A. QUICK INSTALLATION GUIDES

This appendix includes Quick Installation Guides for the entire ***BreezeNET PRO Series.***

The Quick Installation Guide is intended for experienced installers and Network Administrators. Any other person wishing to perform installation procedures should refer to the Installation section for each individual unit.

Note: *Do not forget to perform a System Reset after making changes in the setup of a* ***BreezeNET PRO*** *unit.*

A.1. AP-10 PRO/AP-10DE Access Point Quick Installation Guide

⇒ To install the AP-10 PRO:

1. Choose the best location to place the Access Point. Use following guidelines:
   - As high as possible, clearing partitions and tall furnishings.
   - Extend antennas up vertically in relation to the floor.
   - Central location in the intended coverage area.
   - Away from metallic objects, heat and radiation sources.
2. If needed, use a mounting bracket to attach it to the ceiling or a wall.
3. Connect the power supply to a 110/220 VAC power outlet. Connect the power supply output jack to the DC input socket in the back of the unit. Verify that the PWR LED on the front panel is turned On.
4. Using a **straight** Ethernet cable, connect the UTP port on the rear panel of the AP-10 to an outlet in the Ethernet Backbone. Verify that the ETHR LED on the front panel is blinking (provided there is traffic on the LAN).
5. Verify that the INFR LED is Off, indicating that there is no undesired radio transmission that may interfere with normal operation of the Wireless LAN.
6. Once wireless stations in the designated coverage area are present and activated, verify proper sensing of these stations using the LOAD LEDs (L: 1-4 stations, L & M: 5-8 stations, L, M & H: 9 or more).
7. When installing two or more overlapping BreezeNET cells, set a different hopping sequence in each Access Point

⇒ To access System Configuration, Site Survey and Access Control:

1. Use the Monitor cable to connect the MON jack on the rear panel of the unit to the COM port of your ASCII ANSI terminal or PC.
2. Set up communication parameters to the following:
   - Baud Rate: 9600
   - Data Bits: 8
   - Stop Bits: 1

- Parity: None
- Flow Control: None
- Connector: As selected

3. From main menu select System Configuration (1), Site Survey (3), Advanced Settings (2),or Access Control (4).

⇒ To perform System Configuration

1. Select **station status** (1) to view following parameters:
   - Unit's mode (should be AP)
   - HW Address (6 groups of two digits separated by a dash)
   - Current number of associations.
   - Maximum number of associations since last reset.
2. Select **IP and SNMP Parameters** (2) to view or to load relevant parameters' values into non-volatile memory. The system administrator determines values. Load accordingly.
   - IP Address (4 groups of 3 digits separated by dots).
   - Subnet Mask (4 groups of 3 digits separated by dots).
   - Default Gateway Address (4 groups of 3 digits separated by dots).
   - SNMP Traps Sending Enable/Disable (Default is Enabled)
3. Select **Wireless LAN Parameters** (3) to view or set the following parameters (default values are underlined):
   - Hopping Sequence: A number in the range 0-100. Default is 1.
   - ESSID: Up to 32 printable ASCII characters (Default is ESSID1). The ESSID is case-sensitive.
   - Max. Data Rate: 1, 2 or 3 Mbps.
   - Transmit Diversity: 0-Use Two Antennas, 1-Use Antenna No. 1, 2 - Use Antenna No. 2.
   - Mobility: 0 - Stationary, 1 - Portable, 3 - Mobile.
   - Load Sharing: 0-Disabled, 1-Enabled.
4. Select **Bridging** to view or set the following parameters:
   - Bridge Mode: 0-Reject Unknown, 1-Forward Unknown.
   - IP Filtering: 0-Disabled, 1-Forward only IP.
   - Appletalk Tunneling: 0-Disable Tunneling, 1-Enable Tunneling.
5. Select **Station Control** to Reset Unit or Load Default Parameters:

- Reset Unit: 0 - Cancel Request, 1 - Reset System.
- Set Factory Defaults: 0 - Cancel Request, 1 - Load Default Values.

⇒ To view the Site Survey Menu:

1. Select **System Counters** (1) to view or reset counters.
2. Select Survey Software (2) to view or set survey software parameters or to start site survey statistics (default values are underlined):
   - Mode of Operation: 0-Idle mode, 1-Rx Only, 2-Transmit packets.
   - Data Type: 0-Null Packets, 1-Pseudo-random Data.
   - Data Rate: 1Mbps, 2Mbps or 3Mbps.
   - Antenna: 0-Automatic Selection, 1-Antenna # 1, 2-Antenna # 2.
   - Power Level: 0-Low Level, 1-High Level.
   - No of Packets to Tx: enter number of packets in the range 0-64,000. Default is 0 (stands for infinite).
   - Time between Packets: enter a number in the range 0-64,000.Values interpreted as seconds/10. 0 =1/10 second. Default is 3 (3/10 second)
   - Packet Length: enter a number in the range 24-500. Default is 400.
   - Type (S) to start display of statistics.
   - Type (Q) to stop update of statistics.

⇒ To view or modify access rights in the Access Control Menu:

1. Change Access Rights: 0-User, 1-Installer, 2-Technician.
2. Change Installer Password: Type Password (up to 8 printable ASCII characters).

A.2. SA-10 PRO Station Adapter Quick Installation Guide

⇒ To install the SA-10 PRO Station Adapter:

1. Use the following guidelines to find the best location to position the Station Adapter:
   - Position the unit as high as possible, clearing partitions and tall furnishings.
   - Extend integral antennas up vertically in relation to the floor.
   - Position the unit away from metallic objects, heat and radiation sources.
2. Connect the power supply to a 110/220 VAC power outlet. Connect the power output jack of the power supply to the DC input socket in the back of the unit. Verify that the PWR LED on the front panel is turned On.
3. Using a **straight** Ethernet cable, connect the UTP port on the rear panel of the SA-10 to the socket of the Ethernet Network Interface Card of the station. Verify that the ETHR LED on the front panel is blinking (Provided there is traffic on the Ethernet port).
4. The WLNK LED on the front panel should illuminate once the unit is synchronized with the associated Access Point.
5. Use the QLT LEDs indicators on the front panel to estimate quality of signal received from the AP-10. Try to change position of the unit (or other objects near it) to achieve maximal quality:
   L LED is ON: Low Quality; L & M LEDs are On: Medium Quality; L, M & H LEDs are On: High Quality.

⇒ To access System Configuration, Site Survey and Access Control:

1. Use the Monitor cable to connect the MON jack on the rear panel of the unit to the COM port of your ASCII ANSI terminal or PC.
2. Set up communication parameters to the following:
   - Baud Rate: 9600
   - Data Bits: 8
   - Stop Bits: 1
   - Parity: None
   - Flow Control: None

- Connector: As selected

3. From main menu select System Configuration (1), Advanced Settings (2), Site Survey (3), or Access Control (4).

⇒ To perform System Configuration:

1. Select **station status** (1) to view the following parameters:
   - Unit's mode (should be Station)
   - HW Address (6 groups of two digits separated by a dash)
   - WLAN Address (6 groups of two digits separated by a dash)
   - Status (SCANNING, ASSOCIATED or SYNC, Waiting for address)
   - AP Address (6 groups of two digits separated by a dash)
   - Total number of associations since last reset.
2. Select **IP and SNMP Parameters** (2) to view or to load relevant parameters' values into non volatile memory. Load values as determined by the system administrator:
   - IP Address (4 groups of 3 digits separated by dots).
   - Subnet Mask (4 groups of 3 digits separated by dots).
   - Default Gateway Address (4 groups of 3 digits separated by dots).
   - SNMP Traps Sending Enable/Disable (Default is Enabled)
3. Select **Wireless LAN Parameters** (3) to view or set following parameters (default values are underlined):
   - Hopping Sequence: N/A (Read Only, dictated by Access Point)
   - ESSID: Up to 32 printable ASCII characters (Default is ESSID1)
   - Max. Data Rate: 1, 2 or 3 Mbps.
   - Transmit Diversity: 0-Use Two Antennas, 1-Use Antenna No. 1, 2 - Use Antenna No. 2.
   - Mobility: 0 - Stationary, 1 - Portable, 3 - Mobile.
   - Load Sharing: 0-Disabled, 1-Enabled.
4. Select **Bridging** to view or set the following parameters:
   - LAN to WLAN Bridging Mode: N/A
   - IP Filtering: 0-Disabled, 1-Forward only IP.
   - Appletalk Tunneling: 0-Disable Tunneling, 1-Enable Tunneling.
5. Select **Station Control** to Reset Unit or Load Default Parameters:
   - Reset Unit: 0 - Cancel Request, 1 - Reset System.

- Set Factory Defaults: 0 - Cancel Request, 1 - Load Default Values.

⇒ To view the Site Survey Menu:

1. Select **System Counters** (1) to view or reset counters.
2. Select Survey Software (2) to view or set survey software parameters or to start site survey statistics:
   - Mode of Operation: 0-Idle mode, 1-Rx Only, 2-Transmit packets.
   - Data Type: 0-Null Packets, 1-Pseudo-random Data.
   - Data Rate: 1Mbps, 2Mbps or 3Mbps.
   - Antenna: 0-Automatic Selection, 1-Antenna # 1, 2-Antenna # 2.
   - Power Level: 0-Low Level, 1-High Level.
   - No of Packets to Tx: enter number of packets in the range 0-64,000. Default is 0 (stands for infinite).
   - Time between Packets: enter a number in the range 0-64,000. Values interpreted as seconds/10. 0 =1/10 second. Default is 3 (3/10 second)
   - Packet Length: enter a number in the range 24-500. Default is 400.
   - Type (S) to start display of statistics.
   - Type (Q) to stop update of statistics.

⇒ To view or change access rights in the Access Control Menu:

1. Change Access Rights: 0-User, 1-Installer, 2-Technician.
2. Change Installer Password: Type Password (up to 8 printable ASCII characters. Factory Default password is user)

A.3. SA-40 PRO Four Port Station Adapter Quick Installation Guide

⇒ To install the SA-40 PRO Four Port Adapter:

1. Use the following guidelines to find the best location to position the Four Port Station Adapter:
   - Position the unit as high as possible, clearing partitions and tall furnishings.
   - Extend integral antennas up vertically in relation to the floor.
   - Position the unit away from metallic objects, heat and radiation sources.
2. Connect the power supply to a 110/220 VAC power outlet. Connect the power output jack of the power supply to the DC input socket in the side panel of the unit. Verify that the PWR LED on the front panel is turned On.
3. Using a **straight** 10 Base-T Ethernet cable, connect any available port on the rear panel of the Four-Port Adapter to the Ethernet Network Interface Card socket of the workstation . Repeat this process for other workstations to be connected to the Four-Port Adapter.
4. Use the LEDs on the rear panel of the unit to check functionality. The left LED underneath each of the four ports should be On when a station is connected to this port. The right LED should be blinking whenever there is Ethernet activity on the Port.
5. The ETHR LED on the front panel of the unit should blink whenever there is Ethernet activity on any of the ports.
6. The WLNK LED on the front panel should be illuminated once the unit is synchronized with the associated Access Point.
7. Use the QLT LEDs indicators on the front panel to estimate the quality of the signal received from the AP-10. Try changing the position of the unit (or other objects near it) to achieve maximal quality:
   L LED is ON: Low Quality; L & M LEDs are On: Medium Quality; L, M & H LEDs are On: High Quality.

⇒ To access System Configuration, Site Survey and Access Control

1. Use the Monitor cable to connect the MON jack on the rear panel of the

unit to the COM port of your ASCII ANSI terminal or PC.

2. Set up communication parameters to the following:
   - Baud Rate: 9600
   - Data Bits: 8
   - Stop Bits: 1
   - Parity: None
   - Flow Control: None
   - Connector: As selected
3. From main menu select System Configuration (1), Advanced Settings (2), Site Survey (3), or Access Control (4).

⇒ To perform System Configuration:

1. Select **station status** (1) to view following parameters:
   - Unit's mode (should be Station)
   - HW Address (6 groups of two digits separated by a dash)
   - WLAN Address (6 groups of two digits separated by a dash)
   - Status (SCANNING, ASSOCIATED or SYNC, Waiting for address)
   - AP Address (6 groups of two digits separated by a dash)
   - Total number of associations since last reset.
2. Select **IP and SNMP Parameters** (2) to view or to load relevant parameters' values into non volatile memory. Load values as determined by the system administrator:
   - IP Address (4 groups of 3 digits separated by dots).
   - Subnet Mask (4 groups of 3 digits separated by dots).
   - Default Gateway Address (4 groups of 3 digits separated by dots).
   - SNMP Traps Sending Enable/Disable (Default is Enabled)
3. Select **Wireless LAN Parameters** (3) to view or set following parameters (default values are underlined):
   - Hopping Sequence: N/A (Read Only, dictated by Access Point)
   - ESS ID: Up to 32 printable ASCII characters (Default is ESSID1)
   - Max. Data Rate: 1, 2 or 3 Mbps.
   - Transmit Diversity: 0-Use Two Antennas, 1-Use Antenna No. 1, 2 - Use Antenna No. 2.
   - Mobility: 0 - Stationary, 1 - Portable, 3 - Mobile.

- Load Sharing: 0-Disabled, 1-Enabled.

4. Select **Bridging** to view or set following parameters:

   - LAN to WLAN Bridging Mode: N/A
   - IP Filtering: 0-Disabled, 1-Forward only IP.
   - Appletalk Tunneling: 0-Disable Tunneling, 1-Enable Tunneling.

5. Select **Station Control** to Reset Unit or Load Default Parameters:

   - Reset Unit: 0 - Cancel Request, 1 - Reset System.
   - Set Factory Defaults: 0 - Cancel Request, 1 - Load Default Values.

⇒ To view the Site Survey Menu:

1. Select **System Counters** (1) to view or reset counters.
2. Select Survey Software (2) to view or set survey software parameters or to start site survey statistics:

   - Mode of Operation: 0-Idle mode, 1-Rx Only, 2-Transmit packets.
   - Data Type: 0-Null Packets, 1-Pseudo-random Data.
   - Data Rate: 1Mbps, 2Mbps or 3Mbps.
   - Antenna: 0-Automatic Selection, 1-Antenna # 1, 2-Antenna # 2.
   - Power Level: 0-Low Level, 1-High Level.
   - No of Packets to Tx: enter number of packets in the range 0-64,000. Default is 0 (stands for infinite).
   - Time between Packets: enter a number in the range 0-64,000. Values interpreted as seconds/10. 0 =1/10 second. Default is 3 (3/10 second)
   - Packet Length: enter a number in the range 24-500. Default is 400.
   - Type (S) to start display of statistics.
   - Type (Q) to stop update of statistics.

⇒ To view or change access rights in the Access Control Menu:

- Change Access Rights: 0-User, 1-Installer, 2-Technician.
- Change Installer Password: Type Password (up to 8 printable ASCII characters. Factory Default password is user)

A.4. SA-PC PRO Wireless Card Adapter Quick Installation Guide

General Information:

1. Turn on the AP before installing the SA-PC
2. If more than one Type II PCMCIA slot is available, use the top slot for the SA-PC card. After installing the card, raise the integrated antenna so that it is vertical to the floor.
3. Verify correct operation by using the LEDs on the antenna assembly. The upper LED indicates that data is being received. The lower LED indicates that data is being transmitted.

⇒ To install the SA-PC using Windows 95:

1. With Windows 95 running, insert the ***BreezeNET SA-PC PRO*** adapter into the PCMCIA slot.
2. Windows 95 detects the adapter and displays a dialog box asking for the adapter driver. Click ***Have Disk***, insert the adapter Win 95 network drivers disk and press Enter. Select the driver that now appears in the Install from Disk dialog box and click ***OK***.
3. Windows 95 copies the driver from the disk and may prompt for some Windows 95 setup disks or CD-ROM.
4. The Properties screen appears. Change the default Configuration Option parameter from A to **B**.
5. Set the **ESS ID** to the same value as that set in the AP-10 PRO Access Point (default value is ESSID1).
6. The default Network Type parameter is **Infrastructure**. If you want to set up a peer-to-peer ad-hoc network, change the Network Type to **Ad Hoc**.
7. Click ***OK*** in the network control panel. Windows 95 prompts to restart the computer. Click ***YES***.

Drivers and devices loaded in autoexec.bat and config.sys may cause conflicts with the PC card drivers. If the card does not function properly, check the Device Manager for conflicts

⇒ To check for conflicts:

1. In the Network dialog box, click the Adapters tab and verify the status of

the Wireless LAN Network. An exclamation mark next to the card indicates a conflict.

2. Look for device drivers or lines containing device or call commands in autoexec.bat and/or config.sys.

3. Disable these conflicting drivers and devices and reinstall the card.

⇒ To Install the SA-PC using Windows NT:

1. Insert the BreezeNET SA-PC PRO adapter into the PCMCIA slot before you turn on your laptop.

2. From the desktop, right-click the Network Neighborhood icon and then click **Properties**.

3. Click the Adapters tab in the Network dialog box and then click "**Add**".

4. Insert the provided installation disk and click "**Have Disk**".

5. In the Insert Disk window, type A: at the cursor and click "**OK**".

6. In the Select OEM Option dialog box, click "**OK**".

7. In the Bus Location dialog box, Open the drop-down list in the Type field and select PCMCIA. Click "**OK**".

8. In the Card Setup dialog box, set Configuration to **B**, set the ESSID to the same value as that set in the AP. The default Network Type is AD HOC AFTER INFRASTRUCTURE. This option covers all networking possibilities. Click "**OK**".

9. The Network dialog box reappears displaying the new adapter. Click "**Close**".The system automatically identifies networking protocols. If you are prompted for any configuration parameters, consult your System Administrator.

10. Remove the installation disk and click "**YES**" in the Network Settings Change dialog box to restart the computer.

⇒ To install the SA-PC PRO using Novell Netware - ODI:

In order to operate the SA-PC card, Card and Socket Services must be installed in the portable computer.

1. Carefully insert the SA-PC PRO card into a Type II PCMCIA slot in the computer.

2. Use an extended memory manager such as EMM386.EXE and set

arguments to exclude the 0XD0000-0XDFFFF memory range to prevent conflicts with other devices. (e.g. set the driver statement in CONFIG.SYS as follows:
DEVICE=C:\WINDOWS\EMM386.EXE NOEMS X=D000-DFFF

3. Copy the following files located under the ODI directory in the included SA-PC card installation disk to a new directory:
   - Nesl.com
   - Net.cfg
   - R128D.com
4. Copy Lsl.com, Ipxodi.com, and Vlm.exe (if available) from your Novell client directory to the same directory you created in the previous step.
5. Create a new file named Startnet.bat in the new directory created in step 2. Include the following command (in this order):
   lsl,nesl,r128d,ipxodi and vlm (if available).
6. Edit your Autoexec.bat file and insert the Startnet.bat command. Verify that, when run, it skips all other existing Ethernet PCMCIA drivers.
7. Reboot your computer, start the network and log in at the login prompt.

A.5. WB-10 PRO/WB-10DE Wireless Bridge Quick Installation Guide

⇒ To install the WB-10 PRO Wireless Bridge:

1. Use the following guidelines to find the best location to position the Wireless Bridge:
   - Position the unit as high as possible, clearing partitions and tall furnishings.
   - Extend integral antennas up vertically in relation to the floor.
   - Position the unit away from metallic objects, heat and radiation sources.
2. Connect the power supply to a 110/220 VAC power outlet. Connect the power output jack of the power supply to the DC input socket in the back of the unit. Verify that the PWR LED on the front panel is turned On.
3. Using a **straight** Ethernet cable, connect the UTP port on the rear panel of the WB-10 to the Ethernet hub or to any other available Ethernet outlet. Verify that the ETHR LED on the front panel is blinking (Provided there is traffic on the Ethernet port).
4. The WLNK LED on the front panel should be illuminated once the unit is synchronized with the associated Access Point.
5. Use the QLT LEDs indicators on the front panel to estimate quality of signal received from the AP-10. Try to change position of the unit (or other objects near it) to achieve maximal quality:
   L LED is ON: Low Quality; L & M LEDs are On: Medium Quality; L, M & H LEDs are On: High Quality.

⇒ To access System Configuration, Site Survey and Access Control:

1. Use the Monitor cable to connect the MON jack on the rear panel of the unit to the COM port of your ASCII ANSI terminal or PC.
2. Set up communication parameters to the following:
   - Baud Rate: 9600
   - Data Bits: 8
   - Stop Bits: 1
   - Parity: None
   - Flow Control: None

- Connector: As selected

3. From main menu select System Configuration (1), Advanced Settings (2), Site Survey (3), or Access Control (4).

⇒ To perform System Configuration:

1. Select **station status** (1) to view following parameters:
   - Unit's mode (should be Station)
   - HW Address (6 groups of two digits separated by a dash)
   - WLAN Address (6 groups of two digits separated by a dash)
   - Status (SCANNING, ASSOCIATED or SYNC, waiting for address)
   - AP Address (6 groups of two digits separated by a dash)
   - Total number of associations since last reset.
2. Select **IP and SNMP Parameters** (2) to view or to load relevant parameters' values into non volatile memory. Load values as determined by the system administrator:
   - IP Address (4 groups of 3 digits separated by dots).
   - Subnet Mask (4 groups of 3 digits separated by dots).
   - Default Gateway Address (4 groups of 3 digits separated by dots).
   - SNMP Traps Sending Enable/Disable (Default is Enabled)
3. Select **Wireless LAN Parameters** (3) to view or set following parameters (default values are underlined):
   - Hopping Sequence: N/A (Read Only, dictated by Access Point)
   - ESS ID: Up to 32 printable ASCII characters (Default is ESSID1)
   - Max. Data Rate: 1, 2 or 3 Mbps.
   - Transmit Diversity: 0-Use Two Antennas, 1-Use Antenna No. 1, 2 - Use Antenna No. 2.
   - Mobility: 0 - Stationary, 1 - Portable, 3 - Mobile.
   - Load Sharing: 0-Disabled, 1-Enabled.
4. Select **Bridging** to view or set following parameters:
   - Bridge Mode: 0-Reject Unknown, 1-Forward Unknown.
   - IP Filtering: 0-Disabled, 1-Forward only IP.
   - Appletalk Tunneling: 0-Disable Tunneling, 1-Enable Tunneling.
5. Select **Station Control** to Reset Unit or Load Default Parameters:
   - Reset Unit: 0 - Cancel Request, 1 - Reset System.

- Set Factory Defaults: 0 - Cancel Request, 1 - Load Default Values.

⇒ To view the Site Survey Menu:

1. Select **System Counters** (1) to view or reset counters.
2. Select Survey Software (2) to view or set survey software parameters or to start site survey statistics:
   - Mode of Operation: 0-Idle mode, 1-Rx Only, 2-Transmit packets.
   - Data Type: 0-Null Packets, 1-Pseudo-random Data.
   - Data Rate: 1Mbps, 2Mbps or 3Mbps.
   - Antenna: 0-Automatic Selection, 1-Antenna # 1, 2-Antenna # 2.
   - Power Level: 0-Low Level, 1-High Level.
   - No of Packets to Tx: enter number of packets in the range 0-64,000. Default is 0 (stands for infinite).
   - Time between Packets: enter a number in the range 0-64,000. Values interpreted as seconds/10. 0 =1/10 second. Default is 3 (3/10 second)
   - Packet Length: enter a number in the range 24-500. Default is 400.
   - Type (S) to start display of statistics.
   - Type (Q) to stop update of statistics.

⇒ To view or change access rights in the Access Control Menu:

- Change Access Rights: 0-User, 1-Installer, 2-Technician.
- Change Installer Password: Type Password (up to 8 printable ASCII characters. Factory Default password is user)

Note: Do not forget to do a System Reset after making changes in the setup.

APPENDIX B: WIRELESS LAN CONCEPTS

Wireless LAN technology is becoming increasingly popular for a wide variety of applications. After evaluating the technology, most users are convinced of its reliability, satisfied with its performance and are ready to use it for large-scale and complex wireless networks.

Originally designed for indoor office applications, today's Wireless LANs can be used for both indoor peer-to-peer networks as well as for outdoor point-to-point and point-to-multipoint remote bridging applications.

Wireless LANs can be designed to be modular and very flexible.They can also be optimized for different environments. For example, point-to-point outdoor links are less susceptible to interference and can have higher performance if designers increase the "dwell time" and disable the "collision avoidance" and "fragmentation" mechanisms described later in this section.

Topology

Wired LAN Topology

Traditional LANs (Local Area Networks) link PCs and other computers to one another and to file servers, printers and other network equipment using cables or optic fibers as the transmission medium.

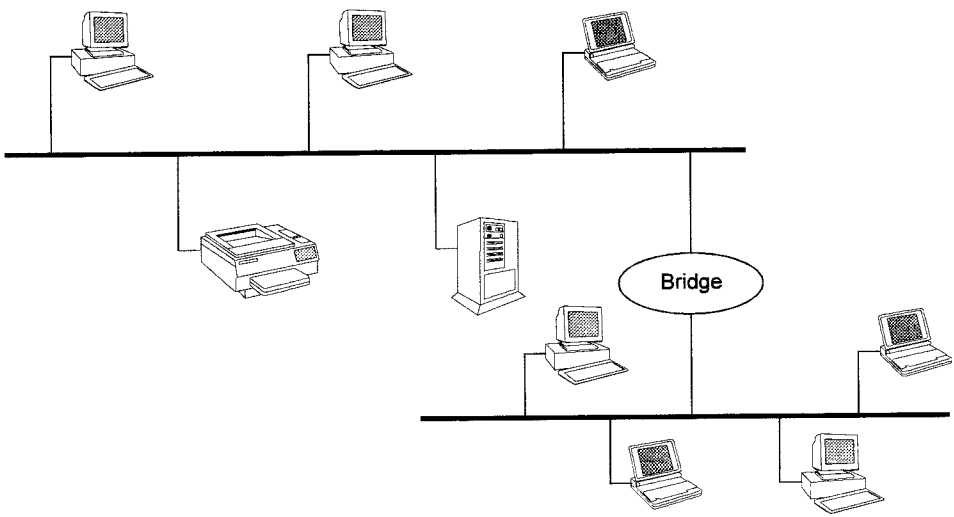


Figure B.1: Wired LAN Topology

Wireless LAN Topology

Wireless LANs allow workstations to communicate and to access the network using radio propagation as the transmission medium. The wireless LAN can be connected to an existing wired LAN as an extension, or can form the basis of a new network. While adaptable to both indoor and outdoor environments, wireless LANs are especially suited to indoor locations such as office buildings, manufacturing floors, hospitals and universities.

The basic building block of the wireless LAN is the *Cell*. This is the area in which the wireless communication takes place. The coverage area of a cell depends on the strength of the propagated radio signal and the type and construction of walls, partitions and other physical characteristics of the indoor environment. PC-based workstations, notebook and pen-based computers can move freely in the cell.

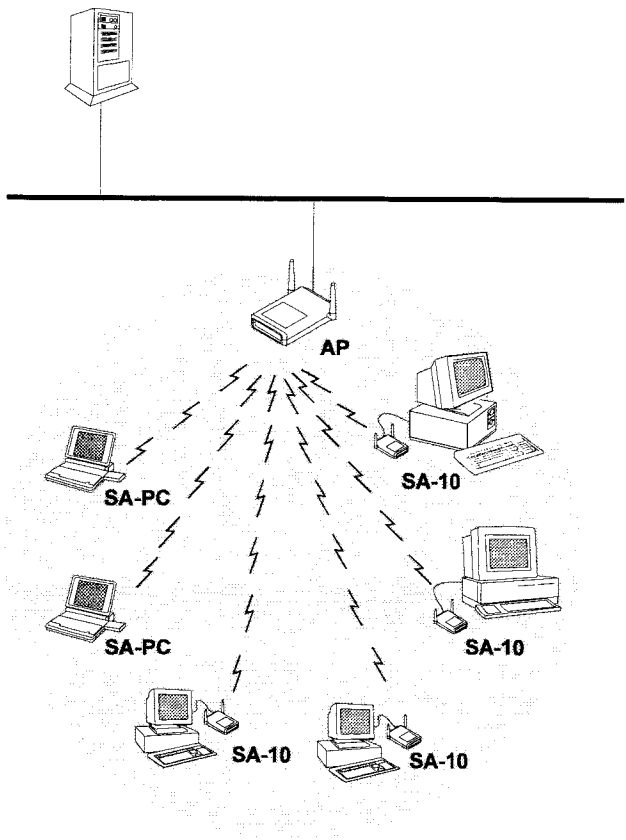


Figure B.2: The Basic Wireless LAN Cell

Each Wireless LAN cell requires some communications and traffic management. This is coordinated by an Access Point (AP) which communicates with each wireless station in its coverage area. Stations also communicate with each other via the AP, so communicating stations can be hidden from one another. In this way, the AP functions as a relay, extending the range of the system.

The AP also functions as a bridge between the wireless stations and the wired network and the other wireless cells. Connecting the AP to the backbone or other wireless cells can be done by wire or by a separate wireless link, using wireless bridges. The range of the system can be extended by cascading several wireless links, one after the other.

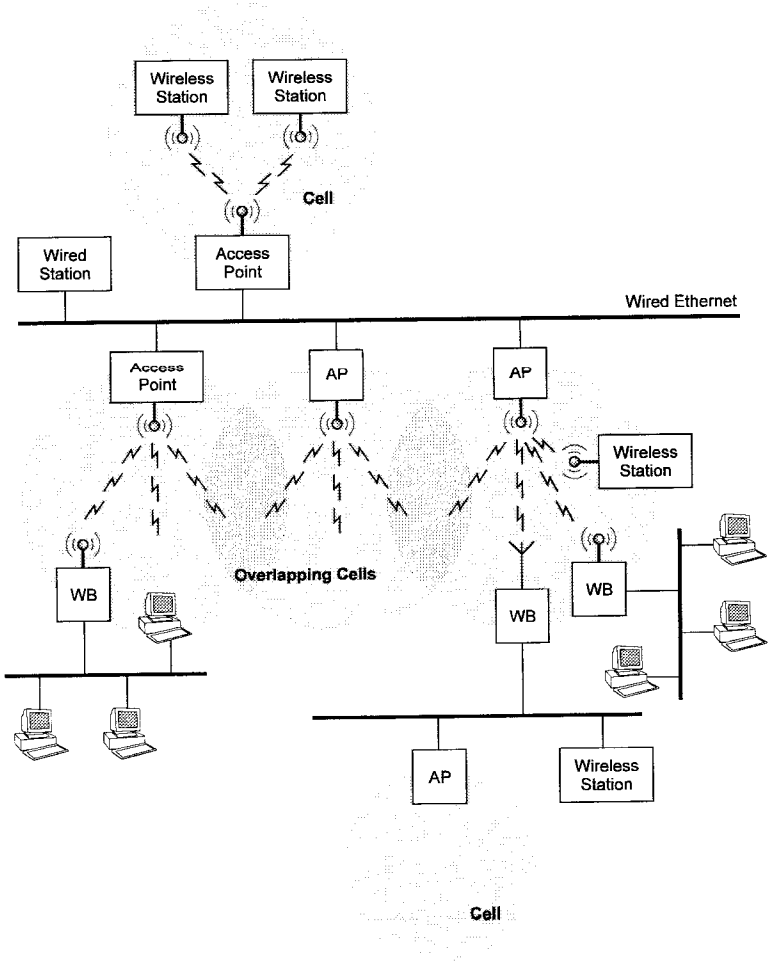


Figure B.3: Wireless LAN Connectivity

Roaming

When any area in the building is within reception range of more than one Access Point, the cells' coverage is said to overlap. Each wireless station automatically establishes the best possible connection with one of the Access Points. Overlapping coverage areas are an important attribute of the wireless LAN setup, because it enables seamless roaming between overlapping cells.

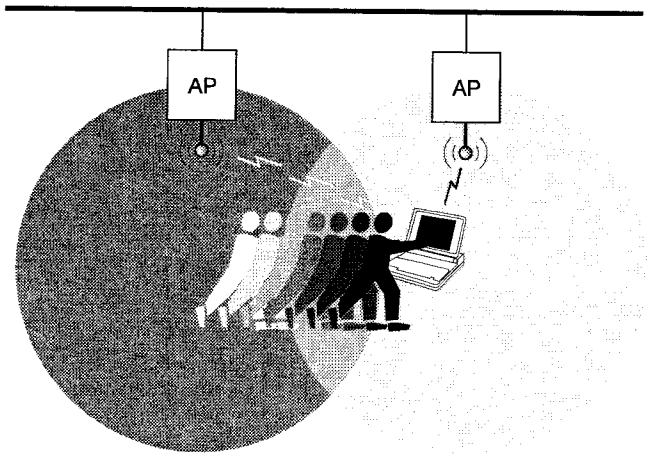


Figure B.4: Roaming Through Overlapping Cells

Roaming allows mobile users with portable stations to move freely between overlapping cells, constantly maintaining their network connection. Roaming is seamless, a work session can be maintained while moving from one cell to another. Multiple access points can provide wireless coverage for an entire building or campus. When the coverage area of two or more APs overlap, the stations in the overlapping area can establish the best possible connection with one of the APs, continuously searching for the best AP. In order to minimize packet loss during switchover, the "old" and "new" APs communicate to coordinate the process.

Load Balancing

Congested areas with many users and heavy traffic load per unit may require a multi-cell structure. In a multi-cell structure, several co-located APs "illuminate" the same area creating a common coverage area which increases aggregate throughput. Stations inside the common coverage area automatically associate with the AP that is less loaded and provides the best signal quality. The stations are equally divided between the APs in order to equally share the load between all APs. Efficiency is maximized because all APs are working at the same low level load. Load balancing is also known as load sharing.

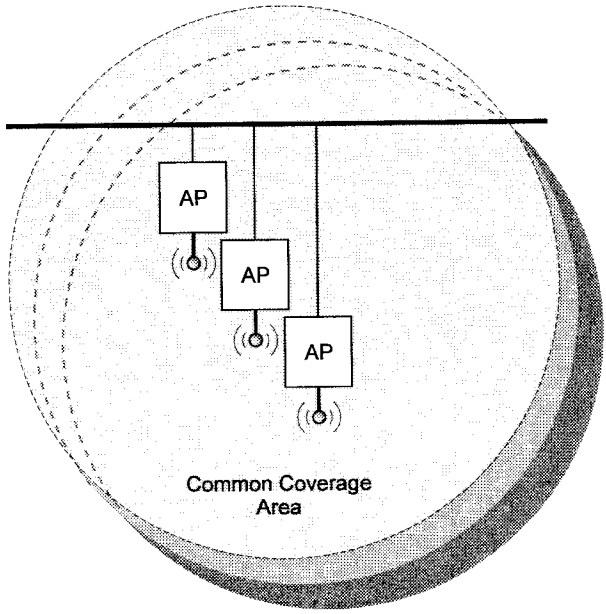


Figure B.5: The Common Coverage Area of a Multi-cell Structure

Dynamic Rate Switching

The data rate of each station is automatically adjusted according to the received signal quality. Performance (throughput) is maximized by increasing the data rate and decreasing re-transmissions. This is very important for mobile applications where the signal quality fluctuates rapidly, but less important for fixed outdoor installations where signal quality is stable.

Media Access

When many users are located in the same area, performance becomes an issue. To address this issue, Wireless LANs use the Carrier Sense Multiple Access (CSMA) algorithm with a Collision Avoidance (CA) mechanism in which each unit senses the media before it starts to transmit. If the media is free for several microseconds, the unit can transmit for a limited time. If the media is busy, the unit will back off for a random time before it senses again. Since transmitting units compete for air time, the protocol should ensure equal fairness between the stations.

Fragmentation

Fragmentation of packets into shorter fragments add protocol overhead and reduce

protocol efficiency when no errors are expected, but reduce the time spent on re-transmissions if errors are likely to occur. No fragmentation or longer fragment length add overhead and reduce efficiency in case of errors and re-transmissions (multi-path).

Collision Avoidance

To avoid collisions with other incoming calls, each station transmits a short RTS (Request To Send) frame before the data frame. The Access Point sends back a CTS (Clear To Send) frame with permission to start the data transmission. This frame includes the time that this station is going to transmit. This frame is received by all the stations in the cell, notifying them that another unit will transmit during the following Xmsec, so they can not transmit even if the media seems to be free (the transmitting unit is out of range).

Channelization

Using Frequency Hopping Spread Spectrum (FHSS), different hopping sequences are assigned to different co-located cells. Hopping sequences are designed so different cells can work simultaneously using different channels.

Since hopping sequences and hopping timing of different cells cannot be synchronized (according to FCC regulations), different cells might try to use the same channel occasionally. Then, one cell uses the channel while the other cell backs off and waits for the next hop. In the case of a very noisy environment (multiples and interference), the system must hop quickly. If the link is quiet and clean, it is better to hop slowly, reducing overhead and increasing efficiency.

APPENDIX C: RADIO SIGNAL PROPAGATION

C.1. Introduction

This appendix is provided to explain and simplify many of the terms relating to antennas and RF (Radio Frequency) used when dealing with an RF installation system.

The following diagram depicts a typical radio system:

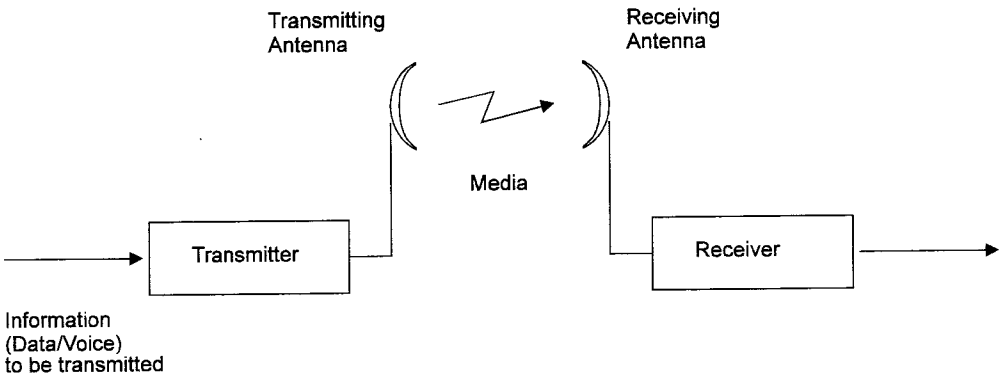


Figure C.1: A Typical Radio System

A radio system transmits information to the transmitter. The information is transmitted through an antenna which converts the RF signal into an electromagnetic wave. The transmission medium for electromagnetic wave propagation is free space.

The electromagnetic wave is intercepted by the receiving antenna which converts it back to an RF signal. Ideally, this RF signal is the same as that originally generated by the transmitter. The original information is then demodulated back to its original form.

C.2. RF Terms and Definitions

dB

The dB convention is an abbreviation for decibels. It is a mathematical expression showing the relationship between two values.

RF Power Level

RF power level at either transmitter output or receiver input is expressed in Watts. It can also be expressed in dBm. The relation between dBm and Watts can be expressed as follows:

$P_{dBm} = 10 \times \text{Log } P_{mw}$

For example: 1 Watt = 1000 mW; $P_{dBm} = 10 \times \text{Log } 1000 = 30$ dBm
100 mW; $P_{dBm} = 10 \times \text{Log } 100 = 20$ dBm

For link budget calculations, the dBm convention is more convenient than the Watts convention.

Attenuation

Attenuation (fading) of an RF signal is defined as follows:

Figure C.2: Attenuation of an RF signal

P_{in} is the incident power level at the attenuator input
P_{out} is the output power level at the attenuator output

Attenuation is expressed in dB as follows:

$P_{dB} = 10 \times \text{Log } (P_{out}/P_{in})$

For example: If, due to attenuation, half the power is lost ($P_{out}/P_{in} = 2$), attenuation in dB is $10 \times \text{Log } (2) = 3_{dB}$

Path Loss

Path loss is the loss of power of an RF signal travelling (propagating) through space. It is expressed in dB. Path loss depends on:

- The distance between transmitting and receiving antennas.
- Line of sight clearance between the receiving and transmitting antennas.
- Antenna height.

Free Space Loss

Attenuation of the electromagnetic wave while propagating through space. This attenuation is calculated using the following formula:

Free space loss = $32.4 + 20\text{xLog}(F_{Mhz}) + 20\text{xLog}(R_{Km})$

F is the RF frequency expressed in Mhz.
R is the distance between the transmitting and receiving antennas.
At 2.4 Ghz, this formula is: $100+20\text{xLog}(R_{Km})$

Antenna Characteristics

Isotropic Antenna

A hypothetical, lossless antenna having equal radiation intensity in all directions. Used as a zero dB gain reference in directivity calculation (gain).

Gain

Antenna gain is a measure of directivity. It is defined as the ratio of the radiation intensity in a given direction to the radiation intensity that would be obtained if the power accepted by the antenna was radiated equally in all directions (isotropically). Antenna gain is expressed in dBi.

Radiation Pattern

The radiation pattern is a graphical representation in either polar or rectangular coordinates of the spatial energy distribution of an antenna.

Side Lobes

The radiation lobes in any direction other than that of the main lobe.

Omni-directional Antenna

This antenna radiates and receives equally in all directions in azimuth. The following diagram shows the radiation pattern of an omnidirectional antenna with its side lobes in polar form.

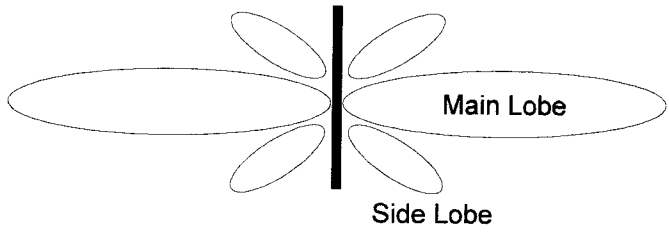


Figure C.3: Side View

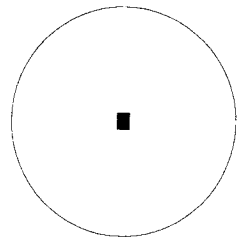


Figure C.4: Top View

Directional Antenna

This antenna radiates and receives most of the signal power in one direction. The following diagram shows the radiation pattern of a directional antenna with its side lobes in polar form:

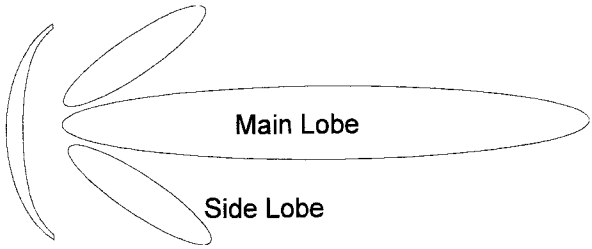


Figure C.5: Radiation Pattern of Directional Antenna

Antenna Beamwidth

The directiveness of a directional antenna. Defined as the angle between two half-power (-3 dB) points on either side of the main lobe of radiation.

System Characteristics

Receiver Sensitivity

The minimum RF signal power level required at the input of a receiver for certain performance (e.g. BER).

EIRP (Effective Isotropic Radiated Power)

The antenna transmitted power. Equal to the transmitted output power minus cable loss plus the transmitting antenna gain.

P_{out}	Output power of transmitted in dBm
Ct	Transmitter cable attenuation in dB
Gt	Transmitting antenna gain in dBi
Gr	Receiving antenna gain in dBi
Pl	Path loss in dB
Cr	Receiver cable attenuation is dB
Si	Received power level at receiver input in dBm
Ps	Receiver sensitivity is dBm

$Si = P_{out} - Ct + Gt - Pl + Gr - Cr$

$EIRP = P_{out} - Ct + Gt$

Example:

Link Parameters:

Frequency: 2.4 Ghz
P_{out} = 4 dBm (2.5 mW)
Tx and Rx cable length (Ct and Cr) = 10 m. cable type RG214 (0.6 dB/meter)
Tx and Rx antenna gain (Gt and Gr) = 18 dBi
Distance between sites = 3 Km
Receiver sensitivity (Ps) = -84 dBm

Link Budget Calculation

EIRP = P_{out} - Ct + Gt = 16 dBm
Pl = 32.4 + 20xLog(FMhz) + 20xLog(RKm) ≅ 110 dB
Si = EIRP - Pl + Gr - Cr = -82 dBm

In conclusion, the received signal power is above the sensitivity threshold, so the link should work. The problem is that there is only a 2 dB difference between received signal power and sensitivity. Normally, a higher margin is desirable due to fluctuation in received power as a result of signal fading.

Signal Fading

Fading of the RF signal is caused by several factors:

- Multipath

  The transmitted signal arrives at the receiver from different directions, with different path lengths, attenuation and delays. The summed signal at the receiver may result in an attenuated signal.

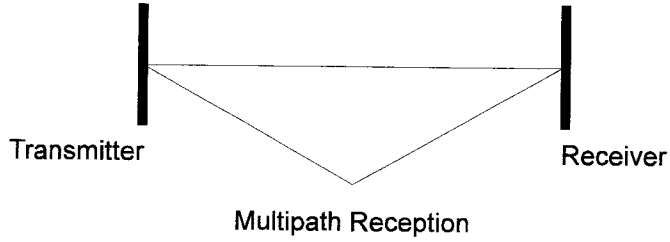


Figure C.6: Multipath Reception

- Bad Line of Sight

  An optical line of sight exists if an imaginary straight line can connect the antennas on either side of the link.

  Radio wave clear line of sight exists if a certain area around the optical line of sight (Fresnel zone) is clear of obstacles. A bad line of sight exists if the first Fresnel zone is obscured.

- Link Budget Calculations
- Weather conditions (Rain, wind, etc.)

  At high rain intensity (150 mm/hr), the fading of an RF signal at 2.4 Ghz may reach a maximum of 0.02 dB/Km.

  Wind may cause fading due to antenna motion.

- Interference

  Interference may be caused by another system on the same frequency range, external noise, or some other co-located system.

The Line of Sight Concept

An optical line of sight exists if an imaginary straight line can be drawn connecting the antennas on either side of the link.

Clear Line of Sight'

A clear line of sight exists when no physical objects obstruct viewing one antenna from the location of the other antenna.

A radio wave clear line of sight exists if a defined area around the optical line of sight (Fresnel Zone) is clear of obstacles.

Fresnel Zone

The Fresnel zone is the area of a circle around the line of sight.
The Fresnel Zone is defined as follows:

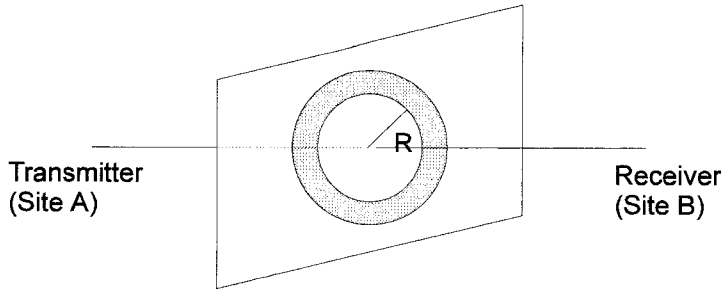


Figure C.7: Fresnel Zone

$R_1^2 = ½ \sqrt{} (\lambda x D)$

R: radius of the first fresnel zone

λ: wavelength

D: distance between sites

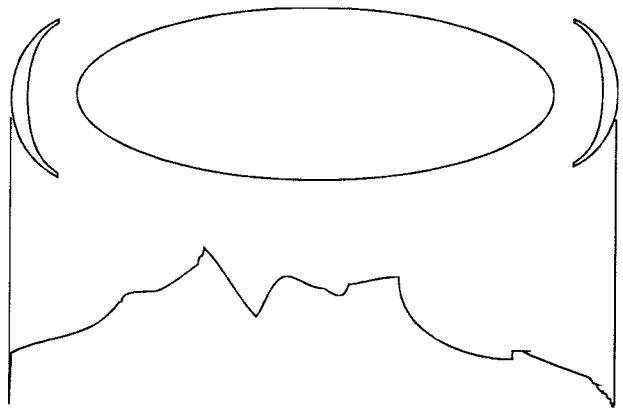


Figure C.8: Fresnel Zone Clear of Obstacles

When at least 80% of the first Fresnel Zone is clear of obstacles, propagation loss is equivalent to that of free space.

APPENDIX D. IEEE 802.11 TECHNICAL TUTORIAL

D.1. Introduction

The purpose of this document is to give technical readers a basic overview of the new 802.11 Standard, enabling them to understand the basic concepts, principle of operations, and some of the reasons behind some of the features and/or components of the Standard.

The document does not cover the entire Standard and does not provide enough information for the reader to implement an 802.11 compliant device (for this purpose the reader should refer to the Standard itself).

D.2. IEEE 802.11 Architecture

Architecture Components

An 802.11 LAN is based on a cellular architecture where the system is subdivided into cells. Each cell (called **Basic Service Set,** or **BSS**, in the 802.11 nomenclature) is controlled by a Base Station (called **Access Point** or, in short, **AP**).

Although a wireless LAN may be formed by a single cell, with a single Access Point, (and as will be described later, it can also work without an Access Point), most installations will be formed by several cells, where the Access Points are connected through some kind of backbone (called **Distribution System** or **DS**). This backbone is typically Ethernet and, in some cases, is wireless itself.

The whole interconnected Wireless LAN, including the different cells, their respective Access Points and the Distribution System, is seen as a single 802 network to the upper layers of the OSI model and is known in the Standard as **Extended Service Set (ESS)**.

The following diagram shows a typical 802.11 LAN including the components described above:

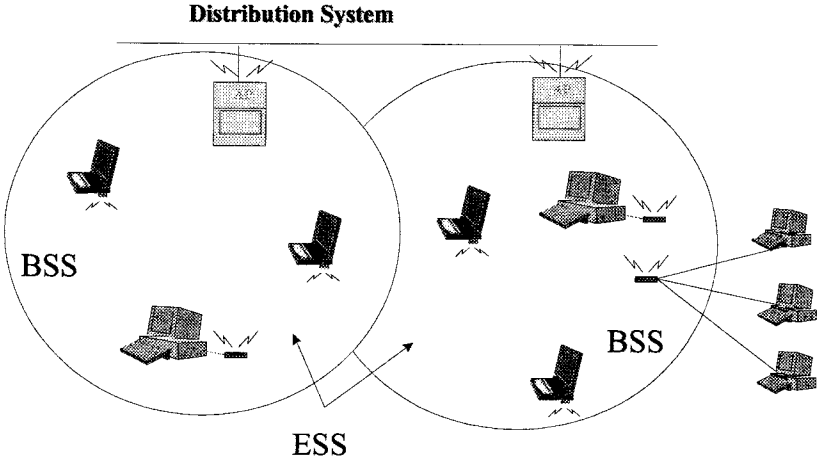


Figure D.1: A Typical 802.11 LAN

The standard also defines the concept of a **Portal**. A portal is a device that interconnects between an 802.11 and another 802 LAN. This concept is an abstract description of part of the functionality of a "translation bridge".

Even though the standard does not necessarily request it, typical installations will have the AP and the Portal on a single physical entity. This is also the case with BreezeCOM's AP which provides both functions.

IEEE 802.11 Layers Description

As any 802.x protocol, the 802.11 protocol covers the MAC and Physical Layer. The Standard currently defines a single MAC which interacts with three PHYs (all of them running at 1 and 2 Mbit/s) as follows:

- Frequency Hopping Spread Spectrum in the 2.4 GHz Band
- Direct Sequence Spread Spectrum in the 2.4 GHz Band, and
- InfraRed

<table>
<tr><td colspan="3">802.2</td><td rowspan="2">Data Link Layer</td></tr>
<tr><td colspan="3">802.11 MAC</td></tr>
<tr><td>FH</td><td>DS</td><td>IR</td><td>PHY Layer</td></tr>
</table>

Beyond the standard functionality usually performed by MAC Layers, the 802.11 MAC performs other functions that are typically related to upper layer protocols, such as Fragmentation, Packet Retransmissions, and Acknowledges.

The MAC Layer

The MAC Layer defines two different access methods, the Distributed Coordination Function and the Point Coordination Function:

The Basic Access Method: CSMA/CA

The basic access mechanism, called the **Distributed Coordination Function**, is basically a Carrier Sense Multiple Access with Collision Avoidance mechanism (usually known as **CSMA/CA**). CSMA protocols are well-known in the industry, the most popular being the Ethernet, which is a CSMA/CD protocol (CD standing for Collision Detection).

A CSMA protocol works as follows: A station desiring to transmit senses the medium. If the medium is busy (i.e. some other station is transmitting) then the station defers its transmission to a later time. If the medium is sensed free then the station is allowed to transmit.

These kinds of protocols are very effective when the medium is not heavily loaded since it allows stations to transmit with minimum delay. But there is always a chance of stations simultaneously sensing the medium as being free and transmitting at the same time, causing a collision.

These collision situations must be identified so the MAC layer can retransmit the packet by itself and not by upper layers, which would cause significant delay. In the Ethernet case this collision is recognized by the transmitting stations which go into a retransmission phase based on an **exponential random backoff** algorithm.

While these Collision Detection mechanisms are a good idea on a wired LAN, they cannot be used on a Wireless LAN environment for two main reasons:

1. Implementing a Collision Detection Mechanism would require the implementation of a Full Duplex radio capable of transmitting and receiving at

once, an approach that would increase the price significantly.

2. In a Wireless environment we cannot assume that all stations hear each other (which is the basic assumption of the Collision Detection scheme), and the fact that a station wants to transmit and senses the medium as free doesn't necessarily mean that the medium is free around the receiver area.

In order to overcome these problems, the 802.11 uses a Collision Avoidance (CA) mechanism together with a Positive Acknowledge scheme, as follows:

1. A station wanting to transmit senses the medium. If the medium is busy then it defers. If the medium is free for a specified time (called Distributed Inter Frame Space (DIFS) in the standard), then the station is allowed to transmit.

2. The receiving station checks the CRC of the received packet and sends an acknowledgment packet (ACK). Receipt of the acknowledgment indicates to the transmitter that no collision occurred. If the sender does not receive the acknowledgment then it retransmits the fragment until it receives acknowledgment or is thrown away after a given number of retransmissions.

Virtual Carrier Sense

In order to reduce the probability of two stations colliding because they cannot hear each other, the standard defines a Virtual Carrier Sense mechanism:

A station wanting to transmit a packet first transmits a short control packet called **RTS** (Request To Send), which includes the source, destination, and the duration of the following transaction (i.e. the packet and the respective **ACK**), the destination station responds (if the medium is free) with a response control Packet called **CTS** (Clear to Send), which includes the same duration information.

All stations receiving either the RTS and/or the CTS, set their **Virtual Carrier Sense** indicator (called **NAV**, for **Network Allocation Vector**), for the given duration, and use this information together with the Physical

Carrier Sense when sensing the medium.

This mechanism reduces the probability of a collision on the receiver area by a station that is "hidden" from the transmitter to the short duration of the RTS transmission because the station hears the CTS and "reserves" the medium as busy until the end of the transaction. The duration information on the RTS also protects the transmitter area from collisions during the ACK (from stations that are out of range of the acknowledging station).

It should also be noted that, due to the fact that the RTS and CTS are short frames, the mechanism also reduces the overhead of collisions, since these are recognized faster than if the whole packet was to be transmitted. (This is true if the packet is significantly bigger than the RTS, so the standard allows for short packets to be transmitted without the RTS/CTS transaction. This is controlled per station by a parameter called **RTS Threshold**).

The following diagrams show a transaction between stations A and B, and the NAV setting of their neighbors:

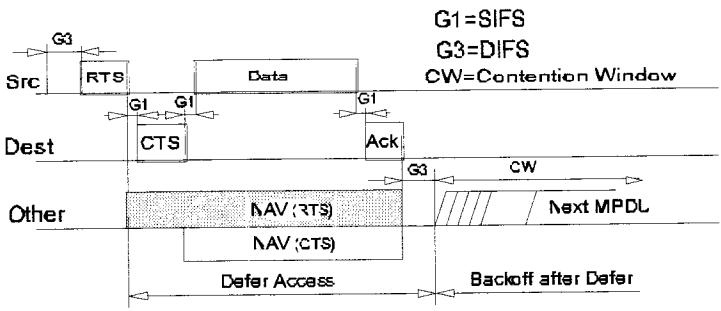


Figure D.2: Transaction Between Stations A and B

The NAV State is combined with the physical carrier sense to indicate the busy state of the medium.

MAC Level Acknowledgments

As mentioned earlier in this document, the MAC layer performs Collision Detection by expecting the reception of an acknowledge to any transmitted fragment (Packets that have more than one destination, such as Multicasts, are not acknowledged.)

Fragmentation and Reassembly

Typical LAN protocols use packets several hundred bytes long (the longest Ethernet packet could be up to 1518 bytes long). There are several reasons why it is preferable to use smaller packets in a Wireless LAN environment:

- Due to the higher Bit Error Rate of a radio link, the probability of a packet getting corrupted increases with the packet size.
- In case of packet corruption (either due to collision or noise), the smaller the packet, the less overhead it causes to retransmit it.
- On a Frequency Hopping system, the medium is interrupted periodically for hopping (in our case every 20 milliseconds), so, the smaller the packet, the smaller the chance that the transmission will be postponed after dwell time.

However, it doesn't make sense to introduce a new LAN protocol that cannot deal with packets 1518 bytes long which are used on Ethernet, so the committee decided to solve the problem by adding a simple fragmentation/ reassembly mechanism at the MAC Layer.

The mechanism is a simple Send-and-Wait algorithm, where the transmitting station is not allowed to transmit a new fragment until one of the following happens:

1. Receives an ACK for the said fragment, or
2. Decides that the fragment was retransmitted too many times and drops the whole frame

It should be noted that the standard does allow the station to transmit to a different address between retransmissions of a given fragment. This is particularly useful when an AP has several outstanding packets to different destinations and one of them does not respond.

The following diagram shows a frame (MSDU) being divided to several fragments (MPDUs):

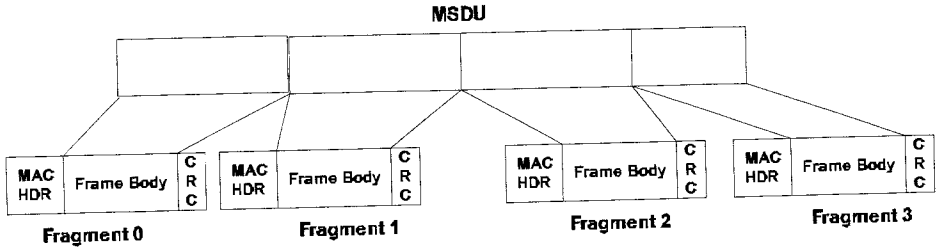


Figure D.3: Frame Fragmentation

Inter Frame Spaces

The Standard defines 4 types of Inter Frame Spaces, which are use to provide different priorities:

- **SIFS - Short Inter Frame Space**, is used to separate transmissions belonging to a single dialog (e.g. Fragment-Ack), and is the minimum Inter Frame Space. There is always at most one single station to transmit at any given time, therefore giving it priority over all other stations.
  This value is a fixed value per PHY and is calculated in such a way that the transmitting station will be able to switch back to receive mode and be capable of decoding the incoming packet. On the 802.11 FH PHY this value is set to 28 microseconds
- **PIFS - Point Coordination IFS**, is used by the Access Point (or Point Coordinator, as called in this case), to gain access to the medium before any other station.
  This value is SIFS plus a Slot Time (defined in the following paragraph), i.e 78 microseconds.
- **DIFS - Distributed IFS**, is the Inter Frame Space used for a station willing to start a new transmission, which is calculated as PIFS plus one slot time, i.e. 128 microseconds.
- **EIFS - Extended IFS**, which is a longer IFS used by a station that has received a packet that it could not understand. This is needed to prevent

the station (which could not understand the duration information for the Virtual Carrier Sense) from colliding with a future packet belonging to the current dialog.

Exponential Backoff Algorithm

Backoff is a well known method used to resolve contention between different stations wanting to access the medium. The method requires each station to choose a Random Number (n) between 0 and a given number, and wait for this number of Slots before accessing the medium, always checking if a different station has accessed the medium before.

The **Slot Time** is defined in such a way that a station will always be capable of determining if another station has accessed the medium at the beginning of the previous slot. This reduces collision probability by half.

Exponential Backoff means that each time the station chooses a slot and happens to collide, it will increase the maximum number for the random selection exponentially.

The 802.11 standard defines an **Exponential Backoff Algorithm**, that must be executed in the following cases:

- When the station senses the medium before the first transmission of a packet, and the medium is busy
- After each retransmission, and
- After a successful transmission

The only case when this mechanism is not used is when the station decides to transmit a new packet and the medium has been free for more than DIFS.

The following figure shows a schematic of the access mechanism:

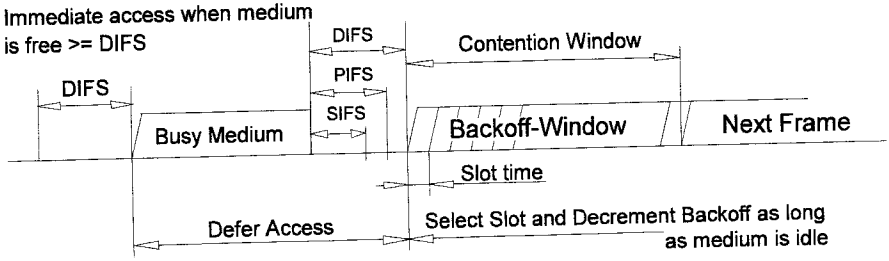


Figure D.4: Access Mechanism

How Does a Station Join an Existing Cell (BSS)?

When a station wants to access an existing BSS (either after power-up, sleep mode, or just entering the BSS area), the station needs to get synchronization information from the Access Point (or from the other stations when in ad-hoc mode, which will be discussed later).

The station can get this information by one of two means:

1. **Passive Scanning**: In this case the station just waits to receive a Beacon Frame from the AP, (the beacon frame is a frame sent out periodically by the AP containing synchronization information), or

2. **Active Scanning:** In this case the station tries to locate an Access Point by transmitting Probe Request Frames, and waits for Probe Response from the AP.

Both methods are valid. A method is chosen according to the power consumption/performance trade-off.

The Authentication Process

Once the station has located an Access Point, and decides to join its BSS, it goes through the **Authentication Process**. This is the interchange of information between the AP and the station, where each side proves the knowledge of a given password.

The Association Process

Once the station is authenticated, it then starts the **Association Process**, which is the exchange of information about the stations and BSS capabilities, and which allows the DSS (the set of APs) to know about the current position of the station). A station is capable of transmitting and receiving data frames only after the association process is completed.

Roaming

Roaming is the process of moving from one cell (or BSS) to another without losing connection. This function is similar to the cellular phones' handover, with two main differences:

1. On a packet-based LAN system, the transition from cell to cell may be performed between packet transmissions, as opposed to telephony where the transition may occur during a phone conversation, this makes the LAN roaming a little easier, but

2. On a voice system, a temporary disconnection may not affect the conversation, while in a packet- based environment it significantly reduces performance because retransmission is then performed by the upper layer protocols.

The 802.11 standard does not define how roaming should be performed, but defines the basic tools. These include active/passive scanning, and a re-association process, where a station which is roaming from one Access Point to another becomes associated with the new one[1].

Keeping Synchronization

Stations need to keep synchronization, which is necessary for keeping hopping synchronized, and other functions like Power Saving. On an infrastructure BSS, this is achieved by all the stations updating their clocks according to the AP's clock, using the following mechanism:

The AP periodically transmits frames called **Beacon Frames**. These frames contain the value of the AP's clock at the moment of transmission (note that this is the moment when transmission actually occurs, and not when it is put

1. The BreezeNet product line provides an patented enhanced roaming mechanism which allows stations to roam at speeds of 60 Km/h without losing or duplicating packets.

in the queue for transmission. Since the Beacon Frame is transmitted using CSMA rules, transmission may be delayed significantly).

The receiving stations check the value of their clocks at the moment the signal is received, and correct it to keep in synchronization with the AP's clock. This prevents clock drifting which could cause loss of synch after a few hours of operation.

Security

Security is one of the first concerns that people have when deploying a Wireless LAN. The 802.11 committee has addressed the issue by providing what is called **WEP (Wired Equivalent Privacy).**

Users are primarily concerned that an intruder should not be able to:

- Access the Network resources by using similar Wireless LAN equipment
- Capture Wireless LAN traffic (eavesdropping)

Preventing Access to Network Resources

This is done by the use of an Authentication mechanism where a station needs to prove knowledge of the current key. This is very similar to Wired LAN privacy, in the sense that an intruder needs to enter the premises (by using a physical key) in order to connect his workstation to the wired LAN.

Eavesdropping

Eavesdropping is prevented by using the WEP algorithm which is a Pseudo Random Number Generator initialized by a shared secret key. This PRNG outputs a key sequence of pseudo-random bits equal in length to the largest possible packet which is combined with the outgoing/incoming packet producing the packet transmitted in the air.

The WEP is a simple algorithm based on RSA's RC4 which has the following properties:

- **Reasonably strong:**
  Brute-force attack to this algorithm is difficult because every frame is sent with an Initialization Vector which restarts the PRNG for each frame.

- **Self Synchronizing**:
  The algorithm re-synchronizes for each message. This is necessary in order to work in a connection-less environment, where packets may get lost (as any LAN).

Power Saving

Wireless LANs are typically related to mobile applications. In this type of application, battery power is a scare resource. This is the reason why the 802.11 standard directly addresses the issue of Power Saving and defines an entire mechanism which enables stations to go into sleep mode for long periods of time without losing information.

The main idea behind the Power Saving Mechanism is that the AP maintains a continually updated record of the stations currently working in Power Saving mode, and buffers the packets addressed to these stations until either the stations specifically request the packets by sending a polling request, or until they change their operation mode.

As part of its Beacon Frames, The AP also periodically transmits information about which Power Saving Stations have frames buffered at the AP, so these stations wake up in order to receive the Beacon Frame. If there is an indication that there is a frame stored at the AP waiting for delivery, then the station stays awake and sends a Polling message to the AP to get these frames.

Multicasts and Broadcasts are stored by the AP, and transmitted at a pre-known time (each DTIM), when all Power Saving stations who wish to receive this kind of frames are awake.

Frame Types

There are three main types of frames:

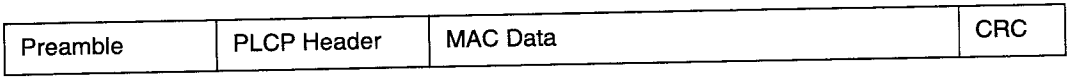
- Data Frames: which are used for data transmission
- Control Frames: which are used to control access to the medium (e.g. RTS, CTS, and ACK), and

- Management Frames: which are frames that are transmitted the same manner as data frames to exchange management information, but are not forwarded to upper layers (e.g. beacon frames).

Each frame type is subdivided into different Subtypes, according to their specific function.

Frame Formats

All 802.11 frames are composed of the following components:



Preamble

This is PHY dependent, and includes:

- **Synch**: An 80-bit sequence of alternating zeros and ones, which is used by the PHY circuitry to select the appropriate antenna (if diversity is used), and to reach steady-state frequency offset correction and synchronization with the received packet timing.
- **SFD**: A Start Frame delimiter which consists of the 16-bit binary pattern 0000 1100 1011 1101, which is used to define frame timing.

PLCP Header

The PLCP Header is always transmitted at 1 Mbit/s and contains Logical information used by the PHY Layer to decode the frame. It consists of:

- **PLCP_PDU Length Word**: which represents the number of bytes contained in the packet. This is useful for the PHY to correctly detect the end of packet.
- **PLCP Signaling Field**: which currently contains only the rate informa-

tion, encoded in 0.5 MBps increments from 1 Mbit/s to 4.5 Mbit/s.

- **Header Error Check Field:** Which is a 16 Bit CRC error detection field.

MAC Data

The following figure shows the general MAC Frame Format. Part of the fields are only present in part of the frames as described later.

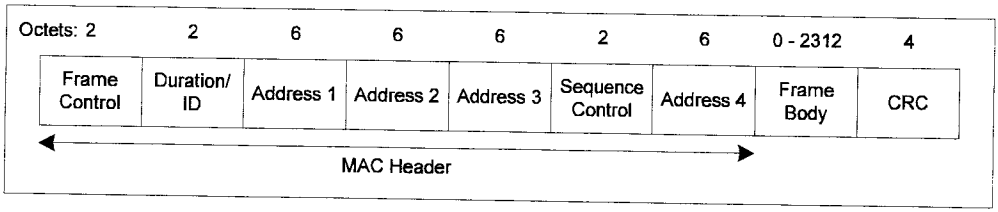


Figure D.5: MAC Frame Format

Frame Control Field

The Frame Control field contains the following information:

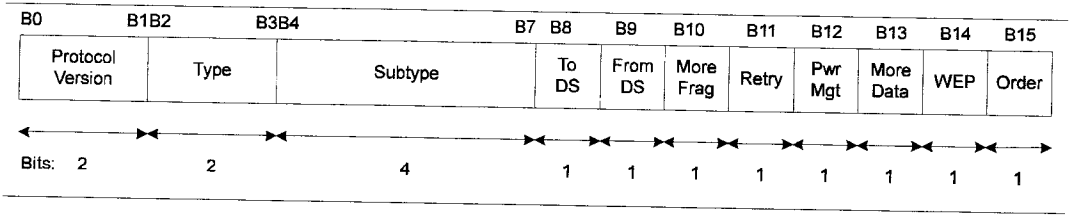


Figure D.6: Frame Control Field

Protocol Version

This field consists of 2 bits which are invariant in size and placement across following versions of the 802.11 Standard, and will be used to recognize possible future versions. In the current version of the standard the value is fixed as 0.

Type and Subtype

This 6 bits define the Type and SubType of the frame as indicated in the following table:

Type Value b3 b2	Type Description	Subtype Value b7 b6 b5 b4	Subtype Description
00	Management	0000	Association Request
00	Management	0001	Association Response
00	Management	0010	Association Request
00	Management	0011	Reassociation Response
00	Management	0100	Probe Request
00	Management	0101	Probe Response
00	Management	0110-0111	Reserved
00	Management	1000	Beacon
00	Management	1001	ATIM
00	Management	1010	Disassociation
00	Management	1011	Authentication
00	Management	1100	Deauthentication
00	Management	1101-1111	Reserved
01	Control	0000-0001	Reserved
01	Control	1010	PS-Poll
01	Control	1011	RTS
01	Control	1100	CTS
01	Control	1101	ACK
01	Control	1110	CF End
01	Control	1111	CF End + CF-ACK
10	Data	0000	Data
10	Data	0001	Data + CF-Ack
10	Data	0010	Data + CF-Poll
10	Data	0011	Data + CF-ACK + CF-Poll
10	Data	0100	Null Function (no data)
10	Data	0101	CF-Ack (no data)
10	Data	0110	CF-Poll (no data)
10	Data	0111	CF-Ack + CF-Poll (no data)
10	Data	1000-1111	Reserved
10	Data	0000-1111	Reserved

ToDS

This bit is set to 1 when the frame is addressed to the AP for forwarding to the Distribution System (including the case where the destination station is in the same BSS, and the AP is to relay the frame).

The Bit is set to 0 in all other frames.

FromDS

This bit is set to 1 when the frame is received from the Distribution System.

More Fragments

This bit is set to 1 when there are more fragments belonging to the same frame following the current fragment.

Retry

This bit indicates that this fragment is a retransmission of a previously transmitted fragment.This is used by the receiver station to recognize duplicate transmissions of frames that may occur when an Acknowledgment packet is lost.

Power Management

This bit indicates the Power Management mode that the station will be in after the transmission of this frame. This is used by stations which are changing state either from Power Save to Active or vice versa.

More Data

This bit is used for Power Management as well as by the AP to indicate that there are more frames buffered to this station. The station may decide to use this information to continue polling or even changing to Active mode.

WEP

This bit indicates that the frame body is encrypted according to the WEP algorithm

Order

This bit indicates that this frame is being sent using the Strictly-Ordered service class.[1]

Duration/ID

This field has two meanings depending on the frame type:

- In Power-Save Poll messages this is the Station ID
- In all other frames this is the duration value used for the NAV Calculation.

Address Fields

A frame may contain up to 4 Addresses depending on the ToDS and FromDS bits defined in the Control Field, as follows:

- **Address-1 is** always the Recipient Address (i.e. the BSS station that is the immediate recipient of the packet). If ToDS is set, this is the AP Address, if ToDS is not set then this is the address of the end-station.
- **Address-2** is always the Transmitter Address (i.e. the station which is physically transmitting the packet). If FromDS is set, this is the AP address, if it is not set then it is the Station address.
- **Address-3** is in most cases the remaining, missing address. On a frame with FromDS set to 1, Address-3 is the original Source Address, if the frame has the ToDS set, then Address 3 is the destination Address.
- **Address-4** is used in special cases where a Wireless Distribution System is used, and the frame is being transmitted from one Access Point to

1. The Strictly-Ordered Service Class is defined for users that cannot accept change of ordering between Unicast Frames and Multicast Frames (ordering of unicast frames to a specific address is always maintained). The only known protocol that would need this service class is DEC's LAT.

another. In such cases, both the ToDS and FromDS bits are set, so both the original Destination and the original Source Addresses are missing.

The following Table summarizes the usage of the different Addresses according to ToDS and FromDS bits setting:

To DS	From DS	Address 1	Address 2	Address 3	Address 4
0	0	DA	SA	BSSID	N/A
0	1	DA	BSSID	SA	N/A
1	0	BSSID	SA	DA	N/A
1	1	RA	TA	DA	SA

Sequence Control

The Sequence Control Field is used to represent the order of different fragments belonging to the same frame, and to recognize packet duplications. It consists of two subfields, Fragment Number and Sequence Number, which define the frame and the number of the fragment in the frame.

CRC

The CRC is a 32 bit field containing a 32-bit Cyclic Redundancy Check (CRC)

Most Common Frame Formats

RTS Frame Format

The RTS frame looks as follows:

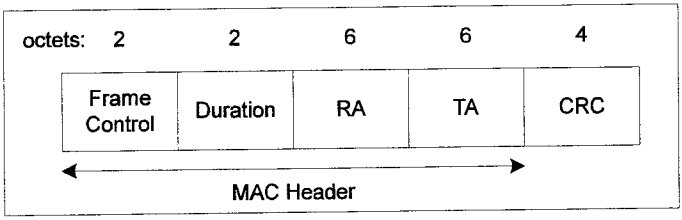


Figure D.7: RTS Frame Format

The RA of the RTS frame is the address of the STA on the wireless medium that is the intended immediate recipient of the next Data or Management frame.

The TA is the address of the STA transmitting the RTS frame.

The Duration value is the time, in microseconds, required to transmit the next Data or Management frame, plus one CTS frame, plus one ACK frame, plus three SIFS intervals.

CTS Frame Format

The CTS frame looks as follows:

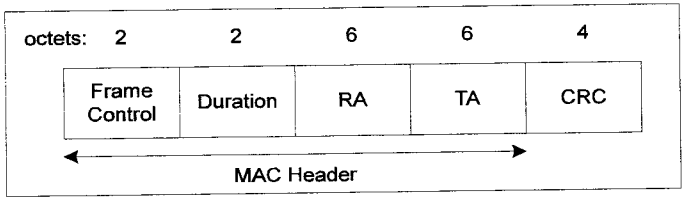


Figure D.8: CTS Frame

The Receiver Address (RA) of the CTS frame is copied from the Transmitter Address (TA) field of the immediately previous RTS frame to which the CTS is a response.

The Duration value is the value obtained from the Duration field of the immediately previous RTS frame, minus the time, in microseconds, required to transmit the CTS frame and its SIFS interval.

ACK Frame Format

The ACK frame looks as follows:

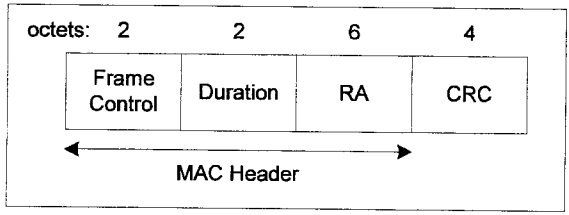


Figure D.9: ACK Frame Format

The Receiver Address of the ACK frame is copied from the Address 2 field of the immediately previous frame.

If the More Fragment bit was set to 0 in the Frame Control field of the previous frame, the Duration value is set to 0, otherwise the Duration value is obtained from the Duration field of the previous frame, minus the time, in microseconds, required to transmit the ACK frame and its SIFS interval.

Point Coordination Function (PCF)

Beyond the basic Distributed Coordination Function, there is an optional Point Coordination Function, which may be used to implement time-bounded services, like voice or video transmission. This Point Coordination Function makes use of the higher priority that the Access Point may gain by the use of a smaller Inter Frame Space (PIFS).

By using this higher priority access, the Access Point issues polling requests to the stations for data transmission, hence controlling medium access. In order to still enable regular stations to access the medium, there is a provision that the Access Point must leave enough time for Distributed Access in between the PCF.

Ad-hoc Networks

In certain circumstances the users may wish to build up Wireless LAN networks without an infrastructure (more specifically without an Access Point). This may include file transfer between two notebooks users, a co-workers meeting outside the office, etc.

The 802.11 Standard addresses this need by the definition of an "ad-hoc" mode of operation. In this case there is no Access Point and part of its functionality is performed by the end-user stations (such as Beacon Generation, synchronization, etc.). Other AP functions are not supported (such as frame-relaying between two stations not in range, or Power Saving).

APPENDIX E. BREEZECOM PRIVATE MIB VERSION 1.0

This private Management Information Base (MIB) supports all products in the ***BreezeNET PRO Series*** as well as the Extended Range Access Point and Wireless Bridge (AP-10DE and WB-10DE).

BreezeCOM agents also support the following public MIBs:

- MIB-II (RFC1213)
- BRIDGE-MIB (RFC1286)

The BreezeNET Private MIB appears as follows:

```
-- Title:     BREEZECOM  Private MIB
--          This Private MIB supports all BREEZECOM products, currently
--          the following products are supported:
--          BreezeNet Product Line.
-- Version:   1.0
-- Date:      20 January 1997
-- By:        Miri Ratner.
-- Comments:  BREEZECOM agents also support the following Public MIBs:
--          - MIB-II (RFC1213)
--          - BRIDGE - MIB (RFC1286)


-- #include "rfc1155.smi"
-- #include "rfc1212.smi"
-- #include "rfc1215.smi"

BREEZECOM-MIB DEFINITIONS: = BEGIN

IMPORTS
--    NetworkAddress, IpAddress,
--    Counter, Gauge, TimeTicks,  enterprises
-- FROM RFC1155
--    OBJECT-TYPE, DisplayString
 FROM RFC1213;
--    TRAP-TYPE
-- FROM RFC-1215;

  MacAddress ::= OCTET STRING (SIZE(6))
--  PhysAddress ::= OCTET STRING (SIZE(6))

-- Some MIB compilers require that the following 6 lines which define the path
-- to BREEZECOM MIB are commented out:
```

```
-- mgmt         OBJECT IDENTIFIER ::= { iso org(3) dod(6) internet(1)  mgmt(2) }
-- mib          OBJECT IDENTIFIER ::= { mgmt 1  }
-- directory    OBJECT IDENTIFIER ::= { internet 1  }
-- experimental OBJECT IDENTIFIER ::= { internet 3  }
-- private      OBJECT IDENTIFIER ::= { internet 4  }
-- enterprises  OBJECT IDENTIFIER ::= { private 1  }

  breezecom       OBJECT IDENTIFIER ::= { enterprises 710 }
  breezecomPrvRev OBJECT IDENTIFIER ::= { breezecom 3 }
  breezecomOID OBJECT IDENTIFIER ::= { breezecom 4 }



--
--        Breezecom Object IDs group
--
          breezecomAP10OBJECT IDENTIFIER ::= {breezecomOID 1 }
          breezecomWB10OBJECT IDENTIFIER ::= {breezecomOID 2 }
          breezecomSA10OBJECT IDENTIFIER ::= {breezecomOID 3 }
          breezecomSA40OBJECT IDENTIFIER ::= {breezecomOID 4 }


  brznetmib       OBJECT IDENTIFIER ::= {breezecomPrvRev 2}

-- BREEZENET private MIB parameters, for Wireless LAN systems management

brzSys OBJECT IDENTIFIER ::= {brznetmib 1}

sysCmd OBJECT IDENTIFIER ::= {brzSys 1}


--
*******************************************************************************
******
-- *     General Command variables
--
*******************************************************************************
******

sysReset OBJECT-TYPE
    SYNTAX  INTEGER {
                    on (1),
                    off (2)
          }
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
    "Setting the value of this attribute to ON is interpreted as a reset
    command for the system. "
    ::= { sysCmd 1 }
```

```
sysSetDefaults OBJECT-TYPE
    SYNTAX  INTEGER {
                    on (1),
                    off (2)
            }
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
    "Setting the value of this attribute to ON will cause the system to
    set the NVRAM parameters to the factory default values. These values
    will become active after the next system reset "
    ::= { sysCmd 2 }

sysResetCounters OBJECT-TYPE
    SYNTAX  INTEGER {
                    on (1),
                    off (2)
            }
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
    "Setting the value of this attribute to ON will cause the system to
     clear the performance counters."
    ::= { sysCmd 3 }

sysTrapEnable OBJECT-TYPE
    SYNTAX  INTEGER{
            on (1),
            off (2)
            }
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
    "Setting the value of this attribute to OFF will disable the system
    from sending TRAPs. "
    ::= { sysCmd 4 }

sysTrapCounter OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
    "This attribute counts the total number of traps generated by the device,
     since initialization. "
    ::= { sysCmd 5 }

sysParams OBJECT IDENTIFIER ::= {brzSys 2}

--
```

```
**************************************************************************
***************
-- *     System level parameters
--
**************************************************************************
***************


brzHWMacAddress OBJECT-TYPE
    SYNTAX  MacAddress
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
    "The Hardware MAC address of the device."
    ::= {sysParams 1 }


brzApplTunneling OBJECT-TYPE
    SYNTAX  INTEGER{
          yes (1),
          no (2)
          }
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
    "Setting the value of this attribute to ON will enable AppleTalk tunneling."
    ::= { sysParams 2 }


brzPositiveBrg OBJECT-TYPE
    SYNTAX  INTEGER{
          forward_unknown (1),
          reject_unknown (2),
                intelligent (3),
                na (255)          -- Not applicable
          }
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
    "This attribute specifies the Wired to Wireless LAN bridging
    mode at the AP, as follows:
          reject_unknown  - The AP forwards to the Wireless LAN only
                                                frames that are destined to associated
                                                stations.
          forward_unknown - The AP forwards to the Wireless LAN frames
                                                destined to associated AND unknown
                                                addresses.
                                                This value should be used only for
                                                Wireless Bridge installations.
          intelligent  - If connected to a wireless bridge, the AP automatically activates the
```

```
                                                    Forward_Unknown option.
        na                              - A not applicable value, for non-AP devices."
        ::= { sysParams 3 }


brzIpFilter OBJECT-TYPE
    SYNTAX  INTEGER{
          on (1),
          off (2),
                  na (255)
          }
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
    "Setting the value of this attribute to ON will cause the
    system to filter all non-IP traffic to the Wireless LAN.
          This should be used on environments where only IP (and ARP)
          traffic is permitted.
    This option is available ONLY on AP (na value assigned in
    non-AP devices."
    ::= { sysParams 4 }


brzTranslationMode OBJECT-TYPE
    SYNTAX  INTEGER{
          on  (1),
          off (2)
          }
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
    "When this attribute is set to ON, data frames are being translated
    for the Wireless LAN transmission. If it is set to OFF, tunneling of
    data frames applies.
    All devices within the same Wireless LAN network, must have the same
    TranslationMode assigned."
    ::= { sysParams 5 }


brzWlanNetID OBJECT-TYPE
          SYNTAX DisplayString (SIZE(31))
    ACCESS read-write
    STATUS mandatory
    DESCRIPTION
          "This attribute identifies the Wireless LAN networkname
          (Extended Service Set ID) for that device. Stations are not
          allowed to associate to APs with different Net IDs."
          ::= { sysParams 7 }
```

```
brzAuthenticationType OBJECT-TYPE
                SYNTAXINTEGER
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
                "This attribute indicates the authentication algorithm used during
                the authentication sequence.
                The value of this attribute is one of the following:
                1  - Open System,
                2  - Shred Key,
                20 - Special Authentication Algorithm (#0),
                21 - Special Authentication Algorithm (#1),
                22 - Special Authentication Algorithm (#2)."
                ::= { sysParams 8 }


ipParams OBJECT IDENTIFIER ::= {brznetmib 2}

--




**************************************************************************
************
-- *     IP and SNMP related parameters
--
**************************************************************************
************

trapHostsTable OBJECT-TYPE
   SYNTAX  SEQUENCE OF TrapHostsEntry
   ACCESS  not-accessible
   STATUS  mandatory
   DESCRIPTION
   "A list of trap_hosts entries."
   ::= { ipParams 1 }

trapHostsEntry OBJECT-TYPE
   SYNTAX  TrapHostsEntry
   ACCESS  not-accessible
   STATUS  mandatory
   DESCRIPTION
   "A trap-receiving host entry, containing
    trap-host objects for a particular host."
   INDEX  { trapHostsIndex }
   ::= { trapHostsTable 1 }

TrapHostsEntry ::=
```

```
    SEQUENCE {
    trapHostsIndex     INTEGER,
    trapIPaddress      IpAddress,
    trapCommunity      DisplayString
    }

trapHostsIndex OBJECT-TYPE
    SYNTAX  INTEGER
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
    "A unique value for each trap_host. Its value
    ranges between 1 and 3"
    ::= { trapHostsEntry 1 }

trapIPaddress OBJECT-TYPE
    SYNTAX  IpAddress
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
    "The ip address of the host to be sent all traps"
    ::= { trapHostsEntry 2 }

trapCommunity OBJECT-TYPE
    SYNTAX  DisplayString (SIZE (0..15))
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
    "The community of the host to be sent all traps"
    ::= { trapHostsEntry 3 }


ipAddr OBJECT-TYPE
    SYNTAX  IpAddress
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
    "The IP address of this device, used to access the device through any
     of its LAN Ports (Ethernet or WLAN)."
    ::= { ipParams 2 }

maskIP OBJECT-TYPE
    SYNTAX  IpAddress
    ACCESS  read-write
    STATUS  mandatory
    DESCRIPTION
    "The IP Network mask used by the IP entity when accessing devices through
    any of its LAN Ports (Ethernet or WLAN)."
    ::= { ipParams 3 }
```

```
readCommunity OBJECT-TYPE
   SYNTAX  DisplayString --(SIZE (0..20))
   ACCESS  read-write
   STATUS  mandatory
   DESCRIPTION
   "The device read community. If updated, it will be used after the
    next reset."
   ::= { ipParams 4 }

writeCommunity OBJECT-TYPE
   SYNTAX  DisplayString --(SIZE (0..20))
   ACCESS  read-write
   STATUS  mandatory
   DESCRIPTION
   "The device write community. If updated, it will be used after the
    next reset."
   ::= { ipParams 5 }



brzWlan OBJECT IDENTIFIER ::= { brznetmib 3 }

brzWlanParams OBJECT IDENTIFIER ::= { brzWlan 1 }

--
*****************************************************************************
************
-- *     WLAN parameters, applicable for both AP and STA devices
--
*****************************************************************************
************

brzMaxRate  OBJECT-TYPE
                SYNTAX INTEGER (1..3)
                ACCESS read-write
                STATUS mandatory
                DESCRIPTION
          "This attribute indicates the rate (in Mbits per
          second) at which data will be transmitted across the
          medium. The default value of this attribute shall be 3."
                ::= { brzWlanParams 1 }

brzMobilLvl  OBJECT-TYPE
                SYNTAX INTEGER  {
                stationary(1),
                portable(2),
                mobile(3),
                multicell(4),
                special (5)
                }
```

```
                ACCESS read-write
                STATUS mandatory
                DESCRIPTION
        "This attribute indicates the expected mobility level of
        the system.The default value of this attribute is stationary."
                ::= { brzWlanParams 2 }

brzAvrgRssi  OBJECT-TYPE
                SYNTAX INTEGER   -- na (255)
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
        "A value representing the average Signal Strength for packets
        received from the current AP.
        This attribute is applicable only for a station
        (An AP will always return a value of 255)."
                ::= { brzWlanParams 3 }

brzWlanProtocol  OBJECT-TYPE
                SYNTAX INTEGER  {
                enhanced (1),
                regular (10)
                }
                ACCESS read-write
                STATUS mandatory
                DESCRIPTION
        "This attribute specifies the MAC/PHY protocol, utilized by this system.
                This attribute is not write accessible for regular users.
                For installations with PCMCIA, the REGULAR option should be utilized."
                ::= { brzWlanParams 4 }

knownAPsTable OBJECT-TYPE  -- aKnownAPs in dot11, with additional quality
                                                        information.
   SYNTAX  SEQUENCE OF KnownAPsEntry
   ACCESS  not-accessible
   STATUS  mandatory
   DESCRIPTION
   "A table of identities of the most recently known Access
   Points, and their signal quality."
   ::= { brzWlanParams 7 }

knownAPsEntry OBJECT-TYPE
   SYNTAX  KnownAPsEntry
   ACCESS  not-accessible
   STATUS  mandatory
   DESCRIPTION
   "An entry in the Known APs table."
   INDEX { knownAPsIndex }
   ::= { knownAPsTable 1 }
```

```
KnownAPsEntry ::=
   SEQUENCE {
   knownAPsIndexINTEGER,
   knownAPsValueMacAddress,
   knownAPsQualityINTEGER,
         knownAPsAvrgRssiINTEGER,
         knownAPsStatusINTEGER
   }

knownAPsIndex OBJECT-TYPE
   SYNTAX  INTEGER
   ACCESS  read-only
   STATUS  mandatory
   DESCRIPTION
   "A unique value, representing the index of the AP in the
   knownAPs table"
   ::= { knownAPsEntry 1 }

knownAPsValue OBJECT-TYPE
  SYNTAX  MacAddress
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
  "This attribute specifies the address of a recently known AP.
  The default value of this attribute shall be null (an empty entry)."
  ::= { knownAPsEntry 2 }

knownAPsQuality OBJECT-TYPE
  SYNTAX  INTEGER  {
  poor (1),
  good (2),
  unknown (10)
  }
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
  "This attribute specifies the current reception quality of frames,
   transmitted by that AP.
   At a station, a GOOD value indicates that the station can join
   that AP."
  ::= { knownAPsEntry 3 }

knownAPsAvrgRssi  OBJECT-TYPE
                  SYNTAX INTEGER
                  ACCESS read-only
                  STATUS mandatory
                  DESCRIPTION
            "A value representing the average Signal Strength for packets
            received from that AP."
                  ::= { knownAPsEntry 4 }
```

```
knownAPsStatus OBJECT-TYPE
  SYNTAX  INTEGER {
  valid   (1),
  invalid (2)
  }
  ACCESS  read-write
  STATUS  mandatory
  DESCRIPTION
  "The validity of the current entry, either invalid or valid."
  ::= { knownAPsEntry 5 }

brzAP OBJECT IDENTIFIER ::= { brzWlan 2 }


bssInfo  OBJECT IDENTIFIER ::= { brzAP 1 }

--
*****************************************************************************
***************
-- *  BSS related parameters, applicable only for the AP
--
*****************************************************************************
***************


bssNumOfStations  OBJECT-TYPE
        SYNTAX  INTEGER
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                "This attribute specifies the number of devices, that are
                currently associated with this AP."
                ::= { bssInfo 1 }

bssNumOfStationsPeak  OBJECT-TYPE
        SYNTAX  INTEGER
                ACCESS  read-only
                STATUS  mandatory
                DESCRIPTION
                "This attribute contains the maximum value that
                bssNumOfStations has reached."
                ::= { bssInfo 2 }


--
*****************************************************************************
***************
-- *  The associated stations information, at the AP
--
```

```
**************************************************************************
***************

bssApAdbOBJECT IDENTIFIER ::= { brzAP 2 }


adbTable OBJECT-TYPE
                SYNTAX SEQUENCE OF AdbEntry
                ACCESS not-accessible
                STATUS mandatory
                DESCRIPTION
        "A table of the stations associated."
                ::= { bssApAdb 1 }

adbEntry  OBJECT-TYPE
                SYNTAX AdbEntry
                ACCESS not-accessible
                STATUS mandatory
      DESCRIPTION
        "An entry in ADB table."
                INDEX { stAddress }
                ::= { adbTable 1 }


AdbEntry ::= SEQUENCE {
                stAddress               PhysAddress,
--              stID                    INTEGER,
--              stState                         INTEGER,
                stCFMode                INTEGER,
                stMaxRate       INTEGER,
                stCurTxRate             INTEGER,
                stRssi                          INTEGER,
                stPMMode                INTEGER,
                stTxFragments   Counter,
                stTxRetry               Counter,
                stTxDroppedPacketsCounter,
                stRxFragments   Counter,
                stWlanStatus    INTEGER,
                stResetCounters INTEGER
                }


stAddress  OBJECT-TYPE
                SYNTAX PhysAddress
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
                "The MAC Address of the station represented by this entry in the
                Association Data Base"
                ::= { adbEntry 1 }
```

```
--stID    OBJECT-TYPE
--                SYNTAX INTEGER
--                ACCESS read-only
--                STATUS mandatory
--                DESCRIPTION
--                " The Station_ID number assigned to this station. This station_ID value is
--                used to refer to the station in special packets of the 802.11 packet
--                (e.g Power Management Support )"
--                ::= { adbEntry 2 }

--stState OBJECT-TYPE
--                SYNTAX INTEGER {
--                associated (1),
--                non_associated (2),
--                associating (3),
--                disassociating (4)
--                }
--                ACCESS read-only
--                STATUS mandatory
--                DESCRIPTION
--                " The current state of the station"
--                ::= { adbEntry 3 }

stCFMode  OBJECT-TYPE
                SYNTAX INTEGER {
        on (1),
        off (2)
                }
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
            "This attribute is set to ON if the station is in the
            Contention Free Polling list of the AP."
                ::= { adbEntry 4 }

stMaxRate  OBJECT-TYPE
                SYNTAX INTEGER
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
           "This attribute indicates the maximum rate (in Mbits per
           second) at which that station transmits data across
           the Wireless medium."
                ::= { adbEntry 5 }

stCurTxRate   OBJECT-TYPE
                SYNTAX INTEGER
                ACCESS read-only
                STATUS mandatory
```

```
                DESCRIPTION
                "The rate currently used by the AP to transmit packets
                to this station"
                ::= { adbEntry 6 }

stPMMode  OBJECT-TYPE
                SYNTAX INTEGER {
                active (1),
                power_saved (2)
                }
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
                "The current Power Management mode of this station"
                ::= { adbEntry 8 }


brzSTA OBJECT IDENTIFIER ::= { brzWlan 3 }

brzCurrentAPMacAddress OBJECT-TYPE
   SYNTAX  MacAddress
   ACCESS  read-only
   STATUS  mandatory
   DESCRIPTION
   "Hardware MAC address of the AP we currently associate with.
    Available ONLY in station."
   ::= { brzSTA 1 }

brzLastAPMacAddress OBJECT-TYPE
   SYNTAX  MacAddress
   ACCESS  read-only
   STATUS  mandatory
   DESCRIPTION
   "The Hardware MAC address of the last AP that the station
   was associated with.
   Available ONLY in stations."
   ::= { brzSTA 2 }

brzPowerMngMode OBJECT-TYPE
   SYNTAX  INTEGER{
         active (1),
         powersave (2)
         }
   ACCESS  read-only
   STATUS  mandatory
   DESCRIPTION
   "This attribute describes the current power management mode of
   the station. The allowable values are ACTIVE (for normal mode
   of operation), and POWER SAVE.
   An AP will always return an ACTIVE value."
```

```
    ::= { brzSTA 6 }


brzCnt OBJECT IDENTIFIER ::= { brznetmib 4 }


-- *    BreezeCom's accumulating counters, for performance monitoring


--
*****************************************************************************
***************
-- *    BreezeCom special Distribution SystemCounters
--
*****************************************************************************
***************

brzDSCnt OBJECT IDENTIFIER ::= { brzCnt 1 }

brzRxFromDS OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This attribute counts the total number of frames that have been
                received successfully from the Wired Distribution system."
    ::= { brzDSCnt 1 }


brzRxBadFromDS OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This attribute counts the number errored frames, received from the
                Wired Distribution system."
    ::= { brzDSCnt 2 }

brzTxToDS OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This attribute counts the total number of frames that have been
                transmitted to the Wired Distribution system."
    ::= { brzDSCnt 4 }

brzWlanCnt OBJECT IDENTIFIER ::= { brzCnt 2 }
```

```
--
*****************************************************************************
***************
-- *     BreezeCom special Wireless LAN Counters
--
*****************************************************************************
***************

brzTxWlanCnt OBJECT IDENTIFIER ::= { brzWlanCnt 1 }

brzTxPacketsToWlan OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This attribute counts the total number of frames (data and
                management) that have been transmitted to the Wireless LAN."
    ::= { brzTxWlanCnt 1 }


brzTxMSDUToWlan OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This attribute counts the total number of frames (data frames)
                that have been transmitted to the Wireless LAN."
    ::= { brzTxWlanCnt 2 }


brzDiscarded OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This attribute counts the number of data frames, that were
                internally discarded is the system, instead of being transmitted
                over the Wireless LAN. High values of this counter indicate
                either very high traffic volume, or a noisy environment
                that prevents Wireless transmissions."
    ::= { brzTxWlanCnt 3 }


brzTxFragToWlan OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This attribute counts the total number of fragments (including
                retransmissions), that weretransmitted to the Wireless LAN."
```

```
    ::= { brzTxWlanCnt 4 }


brzRetryOnWlan OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This attribute counts the total number of retransmitted
                fragments, on the Wireless LAN."
    ::= { brzTxWlanCnt 5 }


brzFailedCountOnWlan OBJECT-TYPE  -- Equals to the dot11 aFailedCount.
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This attribute counts the number of frames that were dropped
                (not transmitted), due to the number of retransmit attempts
                exceeding the RetryMax value."
    ::= { brzTxWlanCnt 6 }


brzRxWlanCnt OBJECT IDENTIFIER ::= { brzWlanCnt 2 }

brzRxPacketsFromWlan OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This attribute counts the total number of frames (data and
                management) that have been received successfully from the
                Wireless LAN."
    ::= { brzRxWlanCnt 1 }


brzRxMSDUFromWlan OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This attribute counts the total number of MSDUs (data frames)
                that have been received successfully from the Wireless LAN."
    ::= { brzRxWlanCnt 2 }


brzRxFragFromWlan OBJECT-TYPE  -- Equals to the dot11 aReceivedFrameCount.
    SYNTAX  Counter
    ACCESS  read-only
```

```
    STATUS  mandatory
    DESCRIPTION
                "This attribute counts the number of fragments (data and
                management), that have been received successfully from the
                Wireless LAN."
    ::= { brzRxWlanCnt 3 }


brzRxBadFragFromWlan OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This counter is incremented when an error is detected in a fragment,
                received from the Wireless LAN."
    ::= { brzRxWlanCnt 4 }


brzRxDuplicateFragFromWlan OBJECT-TYPE  -- Equals to the dot11 aFrameDuplicate-
Count
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
                "This counter is incremented when a duplicated fragment is received
                from the Wireless LAN."
    ::= { brzRxWlanCnt 5 }

brzRoamCnt OBJECT IDENTIFIER ::= { brzCnt 3 }

brzNumOfReassocRequests OBJECT-TYPE
    SYNTAX  Counter
    ACCESS  read-only
    STATUS  mandatory
    DESCRIPTION
    "For an AP: The number of Associations and ReAssociations requests,
      received since the last reset of the AP. This counter is useful
      to get information about mobility activity on the BSS.
    For a Station: The number of Associations and ReAssociation requests
      issued by the station since the last reset."

    ::= { brzRoamCnt 1 }

  brzTraps OBJECT IDENTIFIER ::= { brznetmib 5 }

brzTrapAPMacAddrOBJECT-TYPE
        SYNTAXMacAddress
  ACCESS  read-only
  STATUS  mandatory
  DESCRIPTION
```

```
        "The MAC address of an AP"
    ::= { brzTraps 1 }

brzTrapSTAMacAddrOBJECT-TYPE
        SYNTAXMacAddress
    ACCESS  read-only
    STATUS mandatory
    DESCRIPTION
        "The MAC address of a station device"
    ::= { brzTraps 2 }

brzTrapMacAddressOBJECT-TYPE
        SYNTAXMacAddress
    ACCESS  read-only
    STATUS mandatory
    DESCRIPTION
        "A STA or AP MAC address"
    ::= { brzTraps 3 }

brzTrapRssiQualityOBJECT-TYPE
        SYNTAX INTEGER
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The RSSI level of the signal received from the Access Point"
    ::= { brzTraps 4 }

brzTrapLastRssiQualityOBJECT-TYPE
        SYNTAX INTEGER
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "The RSSI level of the signal received from the previous Access Point"
    ::= { brzTraps 5 }

brzTrapIndexOBJECT-TYPE
        SYNTAX INTEGER
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "Index number for future trap implementation "
    ::= { brzTraps 6 }

brzTrapTextOBJECT-TYPE
        SYNTAX DisplayString
    ACCESS read-only
    STATUS mandatory
    DESCRIPTION
        "Textual string for future trap implementation "
    ::= { brzTraps 7 }
```

```
brzTrapToggleOBJECT-TYPE
        SYNTAX INTEGER{
                on (1),
                off (2)
                }
  ACCESS read-only
  STATUS mandatory
  DESCRIPTION
        "A general ON/OFF toggle value, for the traps."
  ::= { brzTraps 8 }


brzAProamingInTRAP TRAP-TYPE
        ENTERPRISE  breezecom
  VARIABLES {
        brzTrapSTAMacAddr -- Station MAC address
    }
  DESCRIPTION
         "A trap indicating that a station has roamed into this AP.
          It contains the MAC address of the associated station."
        ::= 1

brzAPassociatedTRAP TRAP-TYPE
        ENTERPRISE  breezecom
  VARIABLES {
        brzTrapSTAMacAddr  -- Station MAC address
    }
  DESCRIPTION
         "An AP trap indicating that a new station was associated with
         this AP. It contains the MAC address of the associated
         station."
        ::= 2

brzAPdisassociatedTRAP TRAP-TYPE
        ENTERPRISE  breezecom
  VARIABLES {
        brzTrapSTAMacAddr  -- Station MAC address
    }
  DESCRIPTION
         "An AP trap indicating that the station disassociated itself from
         the AP. The trap contains the MAC address of the disassociated
         station."
        ::= 3

brzAPagingTRAP TRAP-TYPE
        ENTERPRISE  breezecom
  VARIABLES {
        brzTrapSTAMacAddr  -- Station MAC address
    }
```

```
  DESCRIPTION
          "An AP trap indicating that the station association was aged out,
          and removed from that AP. The trap contains the MAC address.
          of the aging station"
         ::= 4

brzAProamedOutTRAP TRAP-TYPE
         ENTERPRISE  breezecom
  VARIABLES {
                  brzTrapSTAMacAddr-- Station MAC address
    }
  DESCRIPTION
          "An AP trap indicating that a given station has roamed out from
          this AP. The trap contains the MAC address of the roamed out station"
         ::= 5

brzSTAassociatedTRAP TRAP-TYPE
         ENTERPRISE  breezecom
  VARIABLES {
           brzLastAPMacAddress,-- Old AP mac address
                  brzTrapAPMacAddr,       -- New AP mac address
                  brzTrapLastRssiQuality,-- Average RSSI with old AP
                  brzTrapRssiQuality      -- Average RSSI with new AP
  }
  DESCRIPTION
          " A station trap, indicating that the station became associated-with,
          or has roamed to another AP. The trap contains the MAC address and
          the average RSSI level of the new AP. If the station was roaming,
          the MAC address of the old AP, and the RSSI level prior to roaming,
          is also provided (for an association, the second address will
          appear as all-zeros)."
         ::= 6


brzGeneralTRAP TRAP-TYPE
         ENTERPRISE  breezecom
  VARIABLES {
                  brzTrapIndex,
    brzTrapText
    }
  DESCRIPTION
          "An AP and STA general purpose trap,
          for future trap implementation."
         ::= 9


  brzdot11 OBJECT IDENTIFIER ::= { brznetmib 6 }

--
*****************************************************************************
```

```
***************
--        rev1dot11 - 801.11 Standard MIB elements
--
*****************************************************************************
***************

-- Station Management Attributes
  dot11smt        OBJECT IDENTIFIER ::= { brzdot11 1 }

  dot11PrivacyGrpOBJECT IDENTIFIER ::= { dot11smt 6 }

dot11PrivacyInvoke OBJECT-TYPE
                SYNTAXINTEGER
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
                "This attribute indicates if a special mechanism is invoked,
                to protect the Wireless LAN transmissions.
                The value is one of the following:
                1 - Standard WEB,
                2 - No Encryption,
                20 - Special Encryption (#0),
                21 - Special Encryption (#1),
                22 - Special Encryption (#2)"
        ::= {dot11PrivacyGrp 3 }


-- MAC Attributes
  dot11mac        OBJECT IDENTIFIER ::= { brzdot11 2 }

  dot11OperationGrpOBJECT IDENTIFIER ::= { dot11mac 1 }


dot11RTSThreshold OBJECT-TYPE
                SYNTAXINTEGER
                ACCESS read-write
                STATUS mandatory
                DESCRIPTION
                "This attribute indicates the number of bytes in an
                MPDU (frame), above which an RTS/CTS handshake will be
                performed. Setting this attribute to be larger than the
                maximum frame size, will have the effect of turning off
                the RTS/CTS handshake for frames transmitted by this
                station."
        ::= {dot11OperationGrp 3 }


dot11ShortRetryLimit OBJECT-TYPE
                SYNTAXINTEGER
                ACCESS read-write
```

```
                STATUS mandatory
                DESCRIPTION
                "This attribute indicates the number of retransmission
                attempts made, before a failure condition is indicated."
        ::= {dot11OperationGrp 4 }


dot11FragmentationThreshold OBJECT-TYPE
                SYNTAXINTEGER
                ACCESS read-write
                STATUS mandatory
                DESCRIPTION
                "This attribute specifies the current maximum size, in octets,
                of the MPDU that will be delivered to the PHY. A frame will be
                broken into fragments if its size exceeds the value of this
                attribute, after adding MAC header and tailers."
        ::= {dot11OperationGrp 6 }


-- Resource Type ID
  dot11res                  OBJECT IDENTIFIER ::= { brzdot11 3 }

  dot11resAttributeOBJECT IDENTIFIER ::= { dot11res 8 }
  dot11ResourceInfo   OBJECT IDENTIFIER ::= {dot11resAttribute 2}

dot11manufacturerName OBJECT-TYPE
        SYNTAX DisplayString (SIZE(20))
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
        "This attribute identifies the manufacturer of the resource."
    ::= { dot11ResourceInfo 3 }

dot11manufacturerProductName OBJECT-TYPE
        SYNTAX DisplayString (SIZE(30))
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
        "This attribute identifies the manufacturer product name of
        the resource."
    ::= {dot11ResourceInfo 4 }

dot11manufacturerProductVersion OBJECT-TYPE
        SYNTAX DisplayString (SIZE(20))
   ACCESS read-only
   STATUS mandatory
   DESCRIPTION
        "This attribute identifies the manufacturer's product version
        of the resource."
    ::= {dot11ResourceInfo 5 }
```

```
-- PHY group
  dot11phy        OBJECT IDENTIFIER ::= { brzdot11 4 }

  dot11PhyOperationGrpOBJECT IDENTIFIER ::= { dot11phy 1 }

dot11CurrentRegDomain OBJECT-TYPE
                SYNTAXINTEGER
                ACCESS read-only
                STATUS mandatory
                DESCRIPTION
                "This attribute specifies the regularity domain, for the
                radio operation of this device.
                This integer contains an 8 bit value, as defined below:
                 10h - USA, 20h - Canada, 30h - Europe, 31h - Spain,
                 32h - France, 37 - Europe Double Deviation,
                 40h - Japan, 48h - Israel, 49h - Australia,
                 60h - Proprietary. "
        ::= {dot11PhyOperationGrp 3 }


  dot11PhyAntennaGrp OBJECT IDENTIFIER ::= { dot11phy 3 }

dot11CurrentTxAntenna OBJECT-TYPE
                SYNTAXINTEGER
                ACCESS read-write
                STATUS mandatory
                DESCRIPTION
                "This attribute specifies the current antenna being used
                to transmit. The value is one of the following:
                 0 - Intelligent antennas selection,
                 1 - Transmitting only with antenna 1,
                 2 - Transmitting always with antenna 2."
        ::= {dot11PhyAntennaGrp 2 }


  dot11PhyTxPwrGrpOBJECT IDENTIFIER ::= { dot11phy 4 }

dot11CurrentTxPwrLvl OBJECT-TYPE
                SYNTAXINTEGER
                ACCESS read-write
                STATUS mandatory
                DESCRIPTION
                "This attribute specifies the power level, currently being
                used to transmit data. The value is one of the following:
                 0 - Low, or 1 - High. "
        ::= {dot11PhyTxPwrGrp 11 }
```

```
dot11PhyFHSSGrp OBJECT IDENTIFIER ::= { dot11phy 5 }


dot11CurrentDwellTime OBJECT-TYPE
                SYNTAXINTEGER
                ACCESS read-write
                STATUS mandatory
                DESCRIPTION
                "This attribute specifies the current time, in millisecond,
                that the radio operates on a single channel.
                The maximum value of this attribute can be 128.
                The same Dwell Time value should be assigned to all the
                devices within the same Wireless LAN network."
        ::= {dot11PhyFHSSGrp 5 }

dot11CurrentPattern OBJECT-TYPE
                SYNTAXINTEGER
                ACCESS read-write
                STATUS mandatory
                DESCRIPTION
                "This attribute represents the current pattern that the
                device is using to determine the hop sequence."
        ::= { dot11PhyFHSSGrp 7 }

END
```